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RESEARCH ARTICLE

COMPARATIVE EVALUATION OF COLOUR STABILITY USING 3 DIFFERENT PROVISIONAL RESTORATIVE MATERIALS WITH RESPECT TO CHROMATOGENS IN INDIAN FOODS AN IN-VITRO STUDY

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ABSTRACT

Aim: The study was aimed to compare the color stability of 3 different types of provisional restorative materials with respect to chromatogens in commonly used Indian foods over a period of 6 weeks.
Methodology: This investigation aims at in vitro comparative study of color stability of commercially available different tooth colored provisional restorative materials in commonly used Indian chromatogens. DPI Heat Cure, DPI Cold cure and RevotecLc were the materials subjected to staining with sambhar, tea and tobacco solution.
Result: Heat cure was found to be the most colour stable material followed by self cure and revote lc. Sambhar solution stained the most.

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INTRODUCTION

Since the mouth is one of the focal points of the face, it comes as no surprise that a smile plays a major role in how we perceive ourselves, as well as the impression we make on the people around us. A charming smile can open doors and knock down barriers that stand between you and a fuller, richer life. Thus, an acceptable cosmetic effect in any dental restoration has been regarded as important to good dentistry. A well-made prosthesis whether provisional or definitive will fail if it is deficient in this respect. A provisional restoration is a transitional restoration that provides protection, stabilization and function before fabrication of a definitive prosthesis. It may also be used to determine esthetics, functional and therapeutic effectiveness of a treatment plan. (?) The provisional restoration may be required to be placed in the patient's mouth for a few days to few weeks. While it is in the patient's mouth, it is required to maintain its function. Amongst the various functions of provisional restorations, esthetics is an important function served by it particularly in the anterior region.

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It serves as a mirror image of the final restoration and often serves as a guide to achieve optimum esthetics in the definitive restoration. It gives the patient an opportunity to voice an opinion. It thus becomes important that the esthetics obtained be maintained till the final restoration is fabricated. Materials available for fabricating provisional crowns and fixed partial dentures include polymethyl methacrylate, polyethylene methacrylate, polyvinyl methacrylate, urethane methacrylate, bisacryl and microfilled resins, each having slightly different proprietary chemistry and properties. Regardless of specific chemistry, dental polymers tend to undergo adsorption of liquids.[2]While the provisional restoration is in use it is prone to come in contact with various food colorants that may discolor the restoration. Thus, color stability of the material becomes an important criterion for the selection of the provisional restorative material. Discoloration of provisional materials for fixed prosthodontics may result in patient dissatisfaction and additional expense for replacement. This is particularly problematic when provisional restorations are subjected to prolonged exposure to colorants during lengthy treatment. The degree of color change can be affected by number of factors, including incomplete polymerization, water sorption, chemical reactivity, diet, oral hygiene, and surface smoothness of the restoration. This investigation aims at in vitro comparative

study of color stability of commercially available different tooth colored provisional restorative materials in commonly used Indian chromatogens. A comparative analysis will help a clinician to select a material that is best suited for a patient that would not only restore esthetics but also maintain esthetics till the final restoration is fabricated.

Aim

The study was aimed to compare the color stability of 3 different types of provisional restorative materials with respect to chromatogens in commonly used Indian foods over a period of 6 weeks.

Objectives

- To evaluate the color stability of heat cured provisional restorative material after immersion in tea, sambhar, tobacco (chromatogens) for a period of 1, 3 and 6 weeks.
- To evaluate the color stability of self cured provisional restorative material after immersion in tea, sambhar, tobacco (chromatogens) for a period of 1, 3 and 6 weeks.
- To evaluate the color stability of light cured provisional restorative material after immersion in tea, sambhar, tobacco (chromatogens) for a period of 1, 3 and 6 weeks.
- To compare the above materials and rate them according to their color stability.
- 5.To evaluate which of the chosen chromatogens (tea, sambhar, tobacco) commonly consumed in India affect the color stability of provisional materials the most.
- The effect of three different staining solutions: sambhar, tea and tobacco on the color stability of three different provisional restorative materials was investigated.

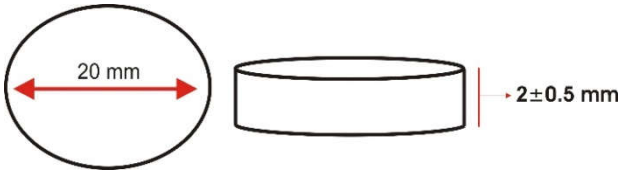
MATERIALS AND METHODS

For convenience and clarity of the description, this study has been subdivided into the following steps

- Preparation of mold
- Specimen fabrication.
- Preparation of staining solutions.
- Color measurements of the specimens.

PREPARATION OF MOLD

Stainless steel mold was made from a round steel rod having diameter 30 mm and height 10 mm.



Schematic representation of specimen

Rod was drilled from the centre to get a round hole having diameter of 20 mm encircled with metal ring of 5 mm width and was cut horizontally to get height of 2.5 mm (Fig 11).

FIG 1: DPI Heat Cure Provisional Material

FIG 2: DPI Self Cure Provisional Material

FIG 3: Revotec LC Light Cure Provisional Material

Specimen fabrication

60 specimens in the shape of flat circular discs (20 mm × 2 ± 0.5 mm) were prepared from each material using circular metal mold of internal diameter 20 mm and thickness 2.5 mm.

For heat cure specimens (DPI), wax patterns (Fig 12) were first fabricated by flowing molten baseplate wax (LINK Dental Modelling Wax) into the mold with petroleum jelly (Vaseline) as separating medium and allowed to harden. The patterns were then invested in Type II dental stone in denture flask (Fig 13 and Fig 14). After dewaxing, separating medium was applied; heat cure polymer and monomer were mixed in the ratio of 3:1 as per the manufacturer's instructions. The resin was packed and processed. (Fig 15) (Anusavice, 2003) For self cure specimens, wax patterns (Fig 12) were first fabricated by flowing molten baseplate wax into the mold with petroleum jelly (Vaseline) as separating medium and allowed to harden (Fig 13 and Fig 14). The patterns were then invested and self cure polymer was processed as per manufacturer's instructions. (Fig 16) (Anusavice, 2003).

For light cure specimens, the moldable material was directly placed into mold with petroleum jelly (Vaseline) as separating medium and cured. (Fig 17) Specimens were kept dry at room temperature until all specimens were fabricated. All specimens upon polymerization were removed from the mold and examined for consistency of the polymerized surface. Specimens were polished by one operator using timed and controlled steps. The polishing media used was coarse pumice powder. Pumice powder and distilled water were mixed to obtain a consistent mix for each specimen. A dental lathe operating at 2880 rpm was used for all polishing procedures. The same operator polished all specimens. Specimens were polished on the testing side using a 15-second application of coarse pumice applied with a moist muslin wheel, followed by 90-degree rotation and another 15-second polish.

FIG 5: Miscellaneous Materials And Armamenterium

FIG 6: Acrylizer

FIG 7: Incubator

FIG 8: Light Cure Unit

FIG 9: Spectrophotometer

FIG 10: Dental Lathe

FIG 11: Stainless Steel Mold

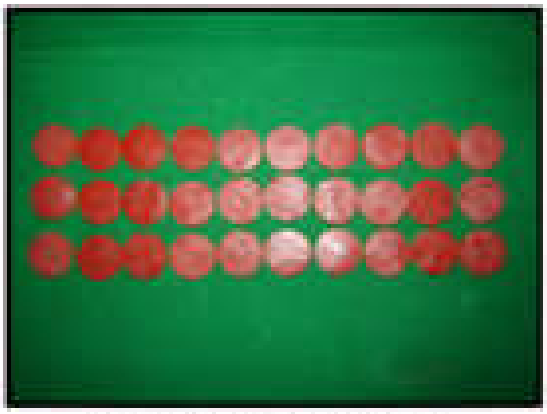


FIG 12: Wax Patterns

FIG 13: Patterns Invested In Dental Stone

FIG 14: Gypsum Mold

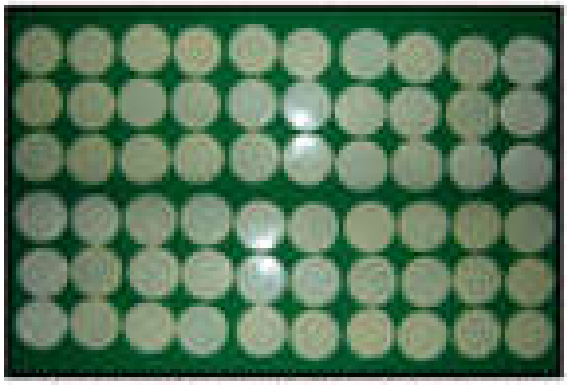


FIG 15: DPI Heat Cure Specimens

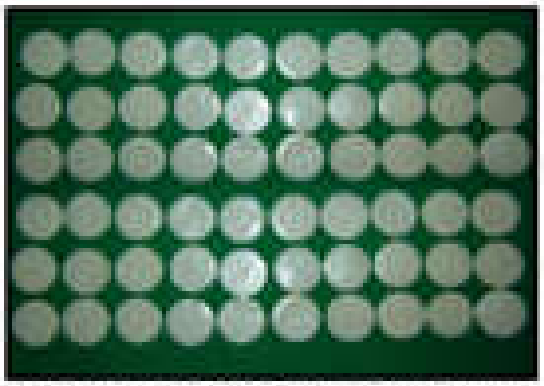


FIG 16: DPI Self Cure Specimens

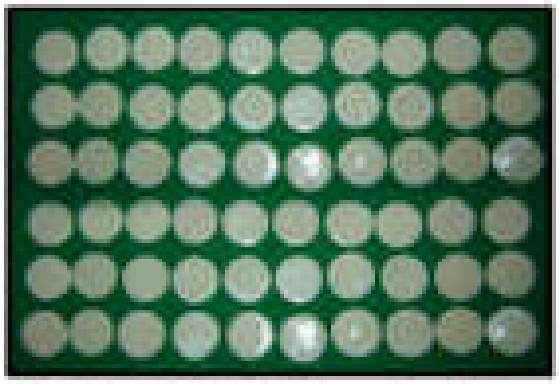


FIG 17: DPI Light Cure Specimens

FIG 18: Specimens Stored In Incubator

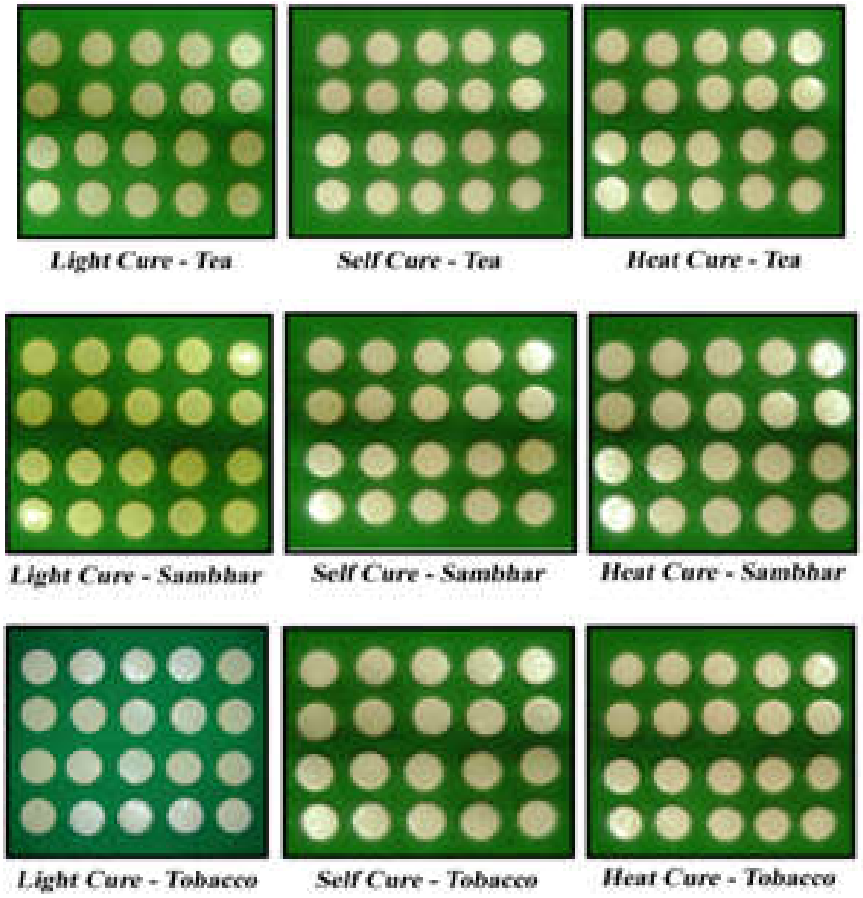


Fig. 19. Color change after 1 week

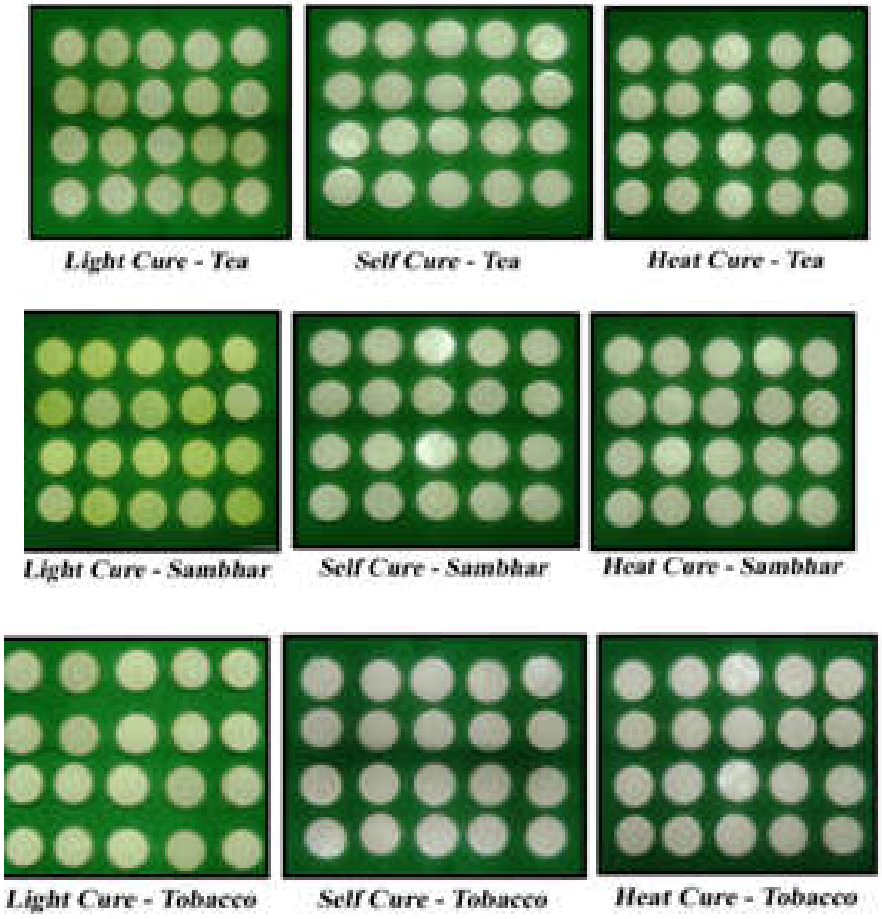


Fig. 19. Color change after 3 week

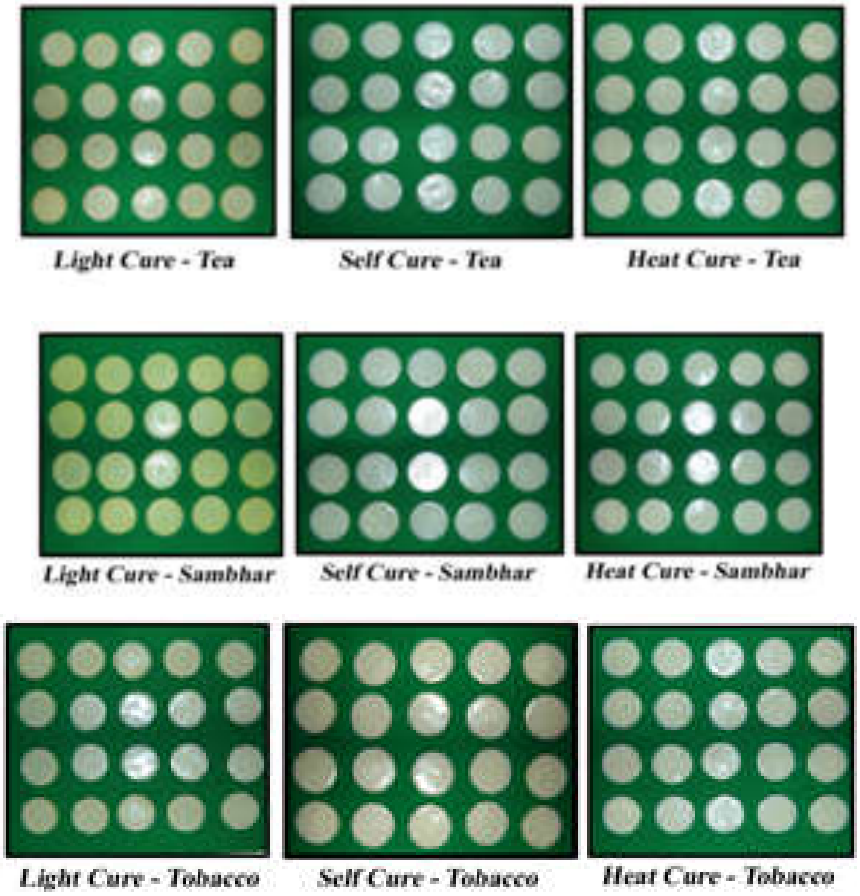


Fig. 19. Color change after 6 week

The materials used in the study were

Provisional restorative materials: (Fig .1, 2, 3)

Product	Material type	Manufacturer	Batch no.
DPI Heat cure	Heat polymerized polymethyl methacrylate	Dental Products Of India, 9 Wallace street, Mumbai.	191
DPI Self cure	Auto polymerized polymethyl methacrylate	Dental Products Of India, 9 Wallace street, Mumbai.	491
Revotek LC	Light polymerized composite resin provisional material.	GC Corporation, Tokyo, Japan.	0904132

Materials used forstaining solutions: (Fig .4)

Product	Material type	Manufacturer	Batch number
Everest	Sambhar masala	(E) S. Narendrakumar& Co, Vikhroli (W), Mumbai.	(E) SM 1103
Society leaf tea	Tea	Amar Tea PVT. LTD., Krishnabai Comp. Bhiwandi-421302, Thane.	(T) 03/2011
Miraj Tobacco	Tobacco	Miraj Products PVT. LTD. Miraj campus, Nathdwara-313301 Rajasthan (India)	-
Artificial Saliva	Artificial saliva	MP Sai Enterprise, Mumbai-53.	-

Before the initial color measurement, visual observation of polished surfaces of all specimens was made and presence of any obvious porosity noted. The specimens were divided into groups of three, with twenty samples each.

Preparation of staining solutions

For the evaluation of color stability, the specimens were immersed in three different staining solutions. The solutions were prepared using a standardized method. The staining solutions were sambhar solution, tea solution and tobacco solution. Sambhar solution was prepared using commercially available sambhar powder which is mixture of many of the Indian spices used - coriander, cumin, chilli, Bengal gram, pigeon pea, fenugreek, rice common salt, curry leaf, tamarind, turmeric, cassia and asafoetida. Sambhar was prepared following manufacturer's instructions. The mixture was boiled for 10 minutes. To form solution, sambhar was diluted using artificial saliva in the ratio of 1:2 i.e. 50 ml of sambhar in 100 ml of artificial saliva. Tea solution was prepared by adding 5gm of tea with 10 gm sugar and 10 gm milk powder in 300 ml of boiling distilled water for 10 minutes. After boiling the tea was filtered. To form solution it was diluted using artificial saliva in the ratio of 1:2 i.e. 50 ml of tea in 100 ml of artificial saliva. Tobacco solution was prepared by soaking 1 sachet i.e. 8 gram of tobacco mixed with lime and menthol (Miraj Tobacco) in 300 ml of distilled water for 30 minutes. It was then filtered and diluted using artificial saliva in the ratio of 1:2

i.e. 50 ml of tobacco solution in 100 ml of artificial saliva. For all the specimens, artificial saliva was used as control. Specimens were kept immersed in artificial saliva at 37 ºC for 24 hours and against this the color change in the specimens immersed in the staining solutions were recorded at an interval of 1, 3 and 6 weeks. The specimens were immersed in sambhar and tea solution at a temperature of 50ºC and in the tobacco solution at a temperature of 37ºC which are the approximate temperatures of their consumption. The specimens were stored at 37ºC in an incubator to simulate the temperature of the oral cavity and evaluated for color change at an interval of 1week, 3 weeks and 6 weeks (Fig 18). New solutions were made everyday.

Color measurements of the specimens

For the measurement of color, the specimens were removed from the staining solution and rinsed with distilled water for 30 seconds and gently cleaned with a medium bristle toothbrush to remove any loose sediment resulting from the staining solution. The specimens were then wiped clean dry using an absorbing tissue paper. Thereafter, the specimens were subjected to spectrophotometric analysis. The spectrophotometer used was Color-i 7 (Xrite). Values of the color change were recorded in the CIELAB color system. The CEILAB color system is an approximately uniform color space with coordinates for lightness, namely, white- black (L), redness - greenness (a) and yellowness-blueness (b). The color was measured of the specimens dipped in artificial saliva, which were taken as standard against which the color change was measured under the different staining solutions at the time interval of 1 week, 3 weeks, and 6 weeks. The color difference was calculated from the means using the following formula:

$$dE\ (L^*a^*b^*) = [\ (dL^*)^2 + (da^*)^2 + (db^*)^2]^{1/2}$$

Where, dL, da, db are the differences in L, a and b values of the specimens in the staining solutions and the specimens in artificial saliva. dE is the color difference between the specimens immersed in staining solutions and specimens in artificial saliva. The color stability of three different types of provisional restorative materials in three different types of Indian chromatogens was determined using a reflectance spectrophotometer. The specimens immersed in artificial saliva were taken as standard and against this the color change in the specimens was recorded. The readings were taken at an interval of 1 week, 3 weeks and 6 weeks. Descriptive statistics are used to describe the basic features of the data in a study. They provide simple summaries about the sample and the measures. Together with simple graphic analysis, they form the basis of virtually every quantitative analysis of data.

Table 1. Mean change in color outcome ΔE after 1 week for each material and staining solution

Materials		N	Mean*	Std. Deviation
Light cure	Sambhar	20	39.84	1.71
	Tea	20	11.16	0.65
	Tobacco	20	6.01	0.54
Self cure	Sambhar	20	3.90	1.23
	Tea	20	4.78	0.88
	Tobacco	20	3.16	0.50
Heat cure	Sambhar	20	1.76	0.27
	Tea	20	2.19	0.72
	Tobacco	20	2.08	0.43
Total		180	8.32	12.17

*P<0.05 significant

Table 2. Mean Percentage of change in color after 1 week for each material and staining solution

Materials		N	Mean*	Std. Deviation
Light cure	Sambhar	20	283.46	11.35
	Tea	20	183.22	29.02
	Tobacco	20	130.06	6.77
Self cure	Sambhar	20	117.59	7.11
	Tea	20	113.72	5.06
	Tobacco	20	111.72	5.09
Heat cure	Sambhar	20	102.17	3.77
	Tea	20	106.76	2.49
	Tobacco	20	107.37	5.38
Total		180	139.56	59.30

*P<0.05 significant

Thus, if we consider the color changes that occur after 1 week, then irrespective of the staining solution heat cure provisional restorative material (DPI) showed the least color change, while light cure provisional restorative material (Revotek LC) showed the highest color change.

Table 3. Mean change in color outcome ΔE after 3 weeks for each material and staining solution

Materials		N	Mean*	Std. Deviation
Light cure	Sambhar	20	26.76	1.07
	Tea	20	8.82	1.05
	Tobacco	20	3.93	0.70
Self cure	Sambhar	20	2.87	1.19
	Tea	20	2.59	0.71
	Tobacco	20	1.85	0.55
Heat cure	Sambhar	20	1.10	0.23
	Tea	20	1.58	0.46
	Tobacco	20	1.31	0.25
Total		180	5.64	8.26

*P<0.05 significant

Also the mean ΔE values for light cure provisional restorative materials in sambhar staining solutions were high compared to tea and tobacco staining solutions. The mean ΔE values and percentage of change in color values for heat cure and self cure provisional restorative material irrespective of staining solution were statistically not significant.

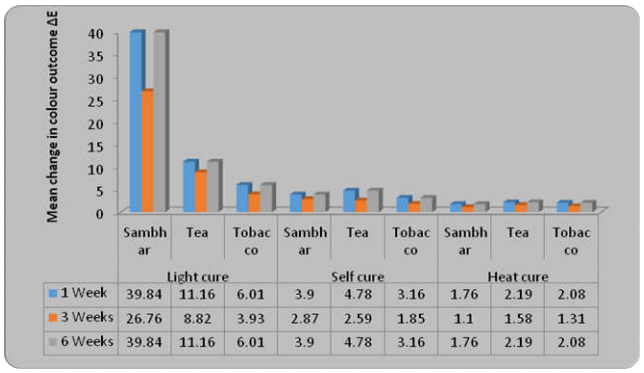
Table 4. Mean Percentage of change in color after 3 weeks for each material and staining solution

Materials		N	Mean*	Std. Deviation
Light cure	Sambhar	20	340.14	25.82
	Tea	20	219.19	20.00
	Tobacco	20	139.50	6.09
Self cure	Sambhar	20	129.09	9.41
	Tea	20	129.30	7.41
	Tobacco	20	120.91	7.00
Heat cure	Sambhar	20	109.61	3.24
	Tea	20	114.97	6.31
	Tobacco	20	112.91	3.06
Total		180	157.29	76.25

* P<0.05 significant

Thus, if we consider the color changes that occur after 3 weeks, then irrespective of the staining solution heat cure provisional restorative material (DPI) showed the least color change, while light cure provisional restorative material (Revotek LC) showed the highest color change. Also the mean ΔE values for light cure provisional restorative materials in sambhar staining solutions were high compared to tea and tobacco staining solutions. The mean ΔE values and percentage of change in color values for heat cure and self cure provisional restorative material irrespective of staining solution were statistically not significant. Thus, if we consider the color changes that occur after 6 weeks, then irrespective of the staining solution heat

cure provisional restorative material (DPI) showed the least color change, while light cure provisional restorative material (Revotek LC) showed the highest color change. Also the mean ΔE values for light cure provisional restorative material in sambhar staining solutions were high compared to tea and tobacco staining solutions. The mean ΔE values and percentage of change in color values for heat cure and self cure provisional restorative material irrespective of staining solution were statistically not significant. Thus, by statistical analysis it is clear that light cure (Revotek LC) provisional restorative material shows highest change in color after 1 week, 3 weeks and 6 weeks of immersion in the staining solutions whereas heat cure (DPI) provisional restorative material shows least change in color after 1 week, 3 weeks and 6 weeks of immersion in the staining solutions. Among the staining solutions sambhar showed the highest staining ability followed by tea whereas tobacco showed the least staining ability. When color differences were compared in each measurement session, it was observed that effect of sambhar on heat cure and self cure provisional restorative material was significantly less than on light cure provisional restorative material. The color shift of heat cure provisional restorative material in tea was greater compared to sambhar but the values were statistically not significant. Mean change in color outcome after 1 week, 3 weeks and 6 weeks for each material and staining solution.



Mean percentage of change in color after 1 week, weeks and 6 weeks for each material and staining solution.

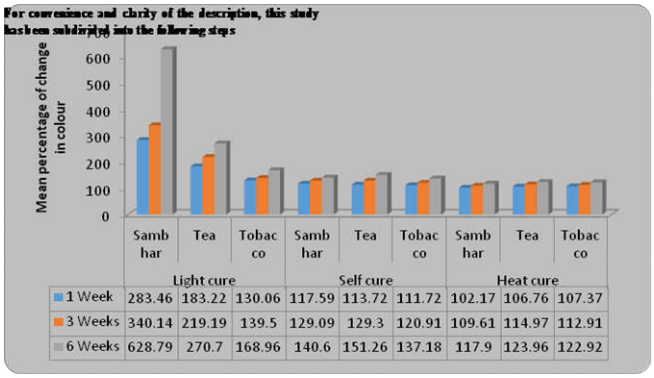


Table 5. Mean change in color outcome ΔE after 6 weeks for each material and staining solution

Materials		N	Mean*	Std. Deviation
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	Tea	20	11.16	0.65
	Tobacco	20	6.01	0.54
Self cure	Sambhar	20	3.90	1.23
	Tea	20	4.78	0.88
	Tobacco	20	3.16	0.50
Heat cure	Sambhar	20	1.76	0.27
	Tea	20	2.19	0.72
	Tobacco	20	2.08	0.43
Total		180	8.32	12.17

*P<0.05 significant

Table 6. Mean Percentage of change in color after 6 weeks for each material and staining solution

Materials		N	Mean*	Std. Deviation
Light cure	Sambhar	20	628.79	72.60
	Tea	20	270.70	17.76
	Tobacco	20	168.96	10.03
Self cure	Sambhar	20	140.60	9.93
	Tea	20	151.26	12.94
	Tobacco	20	137.18	7.02
Heat cure	Sambhar	20	117.90	5.23
	Tea	20	123.96	9.97
	Tobacco	20	122.92	5.82
Total		180	206.91	164.96

*P<0.05 significant

DISCUSSION

Provisional restoration ‘‘provides protection, stabilization, and function before fabrication of the definitive prosthesis. It may also be used to determine the esthetic, functional, and therapeutic effectiveness of a treatment plan”. (?) The prognosis of a fixed restoration depends on the quality of this interim restoration. Materials available for fabricating provisional fixed partial dentures include autopolymerizingpolymethyl methacrylate, polyethylene methacrylate, polyvinyl methacrylate, urethane methacrylate, bis-acryl, and microfilled resin.[43]These materials can be polymerized by chemical, light, or both chemical and light activation. In esthetically critical areas, the provisional restoration must not only provide an initial shade match, but also must maintain an esthetic appearance over the period of service. Perceptible color change of the provisional restorative material may compromise the acceptability of the provisional restoration. Hence, color stability may be a significant criterion in the selection of a particular provisional material for use in an esthetically critical area. (Doray and Powers, 2001) This investigation evaluated the color changes that occurred when the DPI heat cure, DPI self cure and Revotek LC light cure provisional restorative materials were subjected to immersion in sambhar, tea and tobacco staining solutions after 1week, 3 weeks and 6 weeks period.

Provisional restorative materials

The provisional restorative materials are known to undergo color changes when exposed to different environmental conditions. The provisional restorative materials chosen were DPI heat cure, DPI self cure and Revotek LC as these are the materials which are commonly used for fabrication of provisional restorations in routine dental practice. The color stability of the provisional restorative materials can be related to the type of resin matrix, filler and its particle size, degree and type of polymerization, length of time between polishing and finishing, finishing technique, surface finish, degree of glossy surface, water sorption, type of staining agent and the duration of the contact of the staining agent.[22] The color changes in the present study showed that the DPI heat cure was most color stable followed by self cure restorative materials whereas the Revotek LC light cure restorative material was least color stable. These findings were in agreement with the findings of (Crispin and Caputo, 1979). The light polymerized material - Revotek LC showed significant color change after immersion at all intervals in all the solutions. This finding is similar to the findings by (Guler *et al*., 2005).

The discoloration might be due to both surface adsorption and absorption of colorants. Fine colorant particles may have deposited into the pits of the light polymerized material. Large filler particles highly exposed on the surface could produce large surface roughness values resulting in high discoloration. Air voids in the resin material may lead to inhibition zones of unpolymerizedmaterial, resulting in lower color stability. (Ferracane *et al*., 1985) found that in the BIS-GMA resins, the benzoyl peroxide initiator is unstable, especially at elevated temperatures. This instability leads to polymerization of the resin pastes during storage, even in the absence of tertiary amine activators. Breakdown of the tertiary amine and reactions between benzoyl peroxide and inhibitor molecules have been reported to produce colored reaction products in these dental resins. It has been postulated in the previous studies that the amount of filler content as well as the resin matrix has a role to play in the stainability of the materials. (Yannikakis *et al*., 1998) found that composite based resins can absorb water at a higher rate because of high diffusion coefficient in comparison to methyl methacrylate based resins and thus stain more. According to (Haselton *et al*., 2005) the bis-acryl resins showed lesser color stability as compared to the polymethyl methacrylate (PMMA) since bis-acryl polymers are more polar than PMMA polymers and therefore have a greater affinity towards water and other polar liquids. Rough surfaces of restorative materials tend to accumulate more plaque and absorb more water and food colorants. Smooth finished restorations on the other hand show better color stability. Surface roughness of resins is due to irregularly arranged inorganic filler particles and hence get easily stained by mechanical adsorption. (Bagheri *et al*., 2005) It has been proposed that the light polymerized provisional restorative materials have higher roughness because of larger filler particles and pits resulting in more colorant particle deposition. (Guler *et al*., 2005)Heat cured materials show fewer voids than the light cured materials, heat cured materials have higher polymerization rates and thus are found to be more color stable. (Strohaver and Mattie *et al*., 1987)

Finishing techniques

No single technique was recommended for all the materials that were tested. In order to standardize the procedures and since pumice polish is routinely used in clinics for finishing of the restoration; the samples were finished using coarse pumice (Rosenstiel *et al*., 2000) The specimens were also rinsed with distilled water and gently cleaned with a medium bristle toothbrush to remove any loose sediment resulting from the staining solution and to simulate the oral environment.

Staining solutions

The sambhar solution was chosen, as it is a curry that contains most of the Indian chromatogenic spices that are added in the food routinely like turmeric powder and redchilly powder. The preparation of sambhar also contained cooked oil, which is also used in most of the Indian preparations. The tea solution contained sugar and milk powder, as this is the routine preparation of this beverage consumed by Indians. (Guler *et al*., 2005) have shown that the addition of sugar and milk powder results in an increased color change, the differences that were found to be significant.

The tobacco solution was prepared by soaking lime mixed tobacco in distilled water for 30 minutes as on an average each tobacco quid is kept in the oral cavity for a maximum of 30 minutes. The solutions were diluted with artificial saliva with a ratio of 1:2 in order to simulate the oral environment. The temperature of the solutions can be a factor that could affect the final discoloration. (Wozniak et a1., 1981) found that color changes were more in hotter solutions. Thus the specimens were immersed in tea, and sambhar solution at 50ºC, and tobacco solution at 37 ºC approximating the temperature of consumption of these beverages. However, they were stored at 37 ºC in an incubator to simulate the oral environmental conditions. Amongst the solutions tested, sambhar, produced a significant difference after 1week, 3 weeks and 6 weeks, followed by tea and tobacco solutions.

Color measurements

Color can be evaluated with various instruments as well as by visual assessment. By visual assessment, variability may result due to several factors including observed object, illuminant position relative to the observer and to each other, color characteristic of the illuminant, metamerism, fatigue, aging and emotional state of the observer. (Okubo*et al*., 1998) Since instrument measurements eliminate subjective interpretation of visual color comparison, spectrophotometer was used. The color measurements were done in the CIELAB color system, which was developed in 1978 by the Commision Internationale de I'Eclairage for characterizing color for human perception. The CIELAB color space is a uniform three dimensional color order system. The L* coordinate denotes lightness, analogous to Munsell Value. The a* coordinate denotes redness or greenness and b * coordinate denotes yellowness or blueness. The color difference ΔE is the algebric distance between two points in the color space. It represents the relative color changes that are observed for the materials after treatment or between time periods. It has been reported by (Seghi et a1., 1989) that ΔE value equal to 1 is considered visually detectable 50% of the time, whereas ΔE value greater than 2 is perceptible 100% of the time. However, there is another threshold regarding the color stability of the materials. This threshold justifies the clinical acceptability of the stained materials.

The upper limit of acceptability in subjective visual evaluations has been confirmed by (Um and Ruyter *et al*., 1991)who suggested that a perceptible discoloration must be referred to as acceptable up to a value ΔE = 3.3, while Guler *et al*., 2005. Have stated that a value of 3.7 should be considered as visually perceptible (Johnston and Kao, 1989) assessed appearance match by visual observation and clinical colorimetry. Judgements of appearance matching by means of the visual criteria established by the United States Public Health Service (USPHS) and by means of an extended visual rating scale were determined for composite resin veneer restorations and their comparison teeth. A colorimeter of 45°/0° geometry and the CIELAB color order system was used to calculate a color difference for every visual rating of the restorations and comparison teeth. Statistically significant relationships were found between each of the two visual rating systems and the color differences. The average CIELAB color difference of those ratings judged a match by

the USPHS criteria was found to be 3.7. So, in the present investigation we have considered value $\Delta E > 3.7$ as clinically not acceptable. The color was measured of the specimens dipped in saliva, which were taken as standard, against which the color change was measured after immersion in the different staining solutions. The color measurement was done using a reflectance spectrophotometer that incorporates l0-degree observer, 45-degree illumination, with light provided by pulsed xenon arc lamp.

Conclusion

A meticulous esthetic diagnosis followed by a well-defined treatment plan is the foundation of successful esthetic dental treatment. The definitive treatment plan should address the treatment periods, treatment sequencing and all aspects related to the function and maintenance of the anticipated result. Provisional restorations are used in fixed prosthodontics during the interim period between tooth preparation and final prosthetic placement. The maintenance of abutment relationships, function, esthetics, and optimal periodontal health during this period is essential. The prognosis of a fixed restorative procedure is largely dependent upon the quality of the provisional restoration.

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