

Dr. Vedanshi Patel^{*}, Dr. Zarna Saghai^{**}, Dr. Shraddha Choksi^{***}, Dr. Pooja Trivedi^{****}, Dr. Nishit Patel^{*****}, Dr. Purvav Mehta^{*****}

ABSTRACT

AIM: Comparative evaluation of commonly consumed catechu and catechu with lime on color stability of the nano-hybrid composite.

METHOD: A total of 25 uniform cylindrical disks of 10-mm diameter and 1-mm thickness prepared from the nano-hybrid composite were used in the study. Each sample was randomly divided into three subgroups.

Group 1 (n = 10) Catechu, Group 2 (n = 10) Catechu with lime, Group 3 (n = 05) Artificial saliva (Control group)

The samples were immersed in each agent for 15 days. Color changes measurements were noted at the baseline and 15th day by two-dimensional profilometer and spectrophotometer, respectively.

RESULTS: It was found that nano-hybrid composite resin showed more color change when immersed in catechu and catechu with lime as compared to the control group. Intergroup comparison showed statistically significant increase in color change in the catechu group followed by the catechu with the lime group and artificial saliva.

CONCLUSION: Within the limits of the present study, it can be concluded that all experimental specimens showed discoloration. At the end of 15th day, among the groups, catechu showed more color change followed by the catechu and lime and the control group.

KEYWORDS: Catechu; lime; nano-hybrid composite; spectrophotometer

INTRODUCTION:

Esthetics plays a major role in the field of dentistry and its development and research. The trend toward a natural look has paved the way for the development of tooth-colored restorations that simulates the tooth as closely as possible.^[1]

Esthetic failure is one of the most common reasons for the replacement of the restorations. Color changes in resin composites occur from intrinsic and extrinsic factors. Intrinsic factor depends on the composition of the resin matrix, the type of bonding between the filler and matrix, etc., Extrinsic factors such as adsorption or absorption of extrinsic stains pose a major problem for esthetic restorations. Erikson *et al.* suggested that retention of the colored substances from dietary constituents significantly contribute to the formation of extrinsic stains.^{[2],[3],[4]}

Certain unique topographic patterns are observed with respect to the consumption of addictive substances in India, with paan (betel nut leaf) being a highly consumed thing in India, in various forms and compositions. Furthermore, there is a higher consumption of katha (catechu) and lime in the betel nut leaf preparation. This consumption rate of betel nut leaf has been shown to

have a drastic statistical value in the South Asian countries. However, the rate is extremely higher in India and the Indian subcontinent.^[5]

Consumption of these products may affect the esthetic and physical properties of the resin composites thereby undermining the quality of restorations. The chemicals in them can lead to wear and surface degradation of composite restorations resulting in unesthetic external pigmentation such as stains.^[6]

Hence, nano-hybrid composites are considered to be the gold standard materials as posterior restorative material. Still one of the properties of the composite resins that have to pass the test of time is its color stability. In modern day dentistry, a large emphasis is laid over esthetics. Surface staining occurs in nano-hybrid composite due to the oxidation of tertiary amines accelerator which causes a change in hue from whitish-to-yellowish appearance. Color stability is directly proportional to the surface roughness of the composite restoration. Increased surface roughness can lead to greater plaque retention and stain absorption than relatively smoother surface. Catechu itself bearing a strong color and being in a close association of the restoration can lead to staining. There have been

*PG Student, **Professor, *** Professor, ****Reader, *****Reader, *****Reader

CONSERVATIVE DENTISTRY AND ENDODONTICS.

AHMEDABAD DENTAL COLLEGE AND HOSPITAL, TA. KALOL, DIST: GANDHINAGAR, GUJARAT, INDIA.

ADDRESS FOR AUTHOR CORROSPONDENCE : DR. VEDANSHI PATEL, TEL: +91 99098 92142

studies demonstrating the effect of beverages and other foodstuffs as well as cigarette smoking on composite resin; however, there is no literature till date on the effect of catechu and lime on the composites.^{[7],[8]}

Hence, the present study AIMS to evaluate the effect of commonly consumed catechu and catechu with lime on color stability of the conventional nano-hybrid composite resins.

The NULL HYPOTHESIS is there will be no change in the color stability of the nano-hybrid composite at the end of 15 days after they are immersed in catechu and catechu with lime.

MATERIALS & METHOD

25 composite discs of 10 mm in diameter and 1 mm in thickness were prepared using nanohybrid composite (Tetric N-Ceram) with the help of Teflon molds placed on a clean glass slab covered on both sides by cellophane strip to provide uniform thickness and texture.

Color for all the samples were assessed using spectrophotometer for baseline data.

The test agents were prepared using the dilution method. It contains an aqueous solution of the catechu powder. The primary solution was made by using the ratio of 4:1.

To prepare solution for group 1, the measuring quantity was 2.5 g of catechu powder in 10 mL of water. This solution was boiled and then allowed to cool at the room temperature, to make the primary solution (catechu solution).

To prepare the agent for Group 2, lime was added to the primary solution in the ratio of 0.25:1 with continuous stirring until a creamy homogenous formulation is obtained.

25 composite discs were then randomly divided into three groups.

Group 1 (n = 10) Catechu

Group 2 (n = 10) Catechu with lime

Group 3 (n = 05) Artificial saliva (Control group)

The discs of Group 1 and Group 2 were then immersed in the agents for 10 min twice daily for 15 days. The discs were removed and stored in distilled water at 37°C. Discs of group 3 were continuously kept in artificial saliva for 15 days.

Color change for all the samples were assessed using spectrophotometer after 15 days.

RESULTS

Comparing within the test solutions, catechu has shown more color change than catechu with lime at the end of 15 days.

One-way ANOVA test revealed, color changes showed a statistically significant difference ($P < 0.001$) between the baseline and at the end of 15 day (Table 1).

There was a greater color change observed in Group 1 as compared to that of the Group 2 and minimal changes observed in the Group 3 (control group)

Color stability	n	Mean (baseline)	Mean 15 th day	SD	SE	Minimum	Maximum
Group 1	20	34.70	46.56	2.32	0.519	42.63	52.78
Group 2	20	34.63	41.82	1.43	0.320	39.18	43.99
Group 3	10	34.52	34.71	0.94	0.298	32.23	35.61

Table 1 : Mean value of baseline data and at the end of 15th day

Tukey's post hoc test revealed a statistically significant difference in color change between Groups 1 and 2 ($P < 0.001$), Group 1 and control group ($P < 0.001$), and Group 2 and Group 3 (control group) ($P < 0.001$) (Table 2).

Type (I)	Type (J)	Mean difference (I-J)	SE	P
Group 3	Group 1	-11.67	0.712	<0.001
Group 3	Group 2	-7.00	0.712	<0.001
Group 1	Group 2	4.67	0.581	<0.001

Table 2 : Mean difference between values of different groups

DISCUSSION:

Nano-hybrid composite combines the properties of earlier hybrid and microhybrid composite. Nano-hybrid composite has improved mechanical properties.

Hence, nano-hybrid composite is considered to be the gold standard material as posterior restorative material. However, the problem with nano-hybrid composite is surface staining and color stability.

The staining agents catechu and catechu with lime that are selected for the study are common ingredients of paan preparation, that is, consumed very commonly in India and the Indian subcontinent and also has the potential for discoloration of the restorative material.

The samples were immersed for 10 min twice a day because an average consumption of an individual in India is about 2–3 in a day that accounts to roughly about 10 min in one time.

The reason for the increased color change and surface roughness in catechu group may be attributed to the composition of the material that showed the presence of the acid and other phenolic compounds.

Catechu is composed of 13%–33% of crude catechin, also called catechuic acid, and from 22% to 50% of a peculiar tannic acid, called catechu-tannic acid. Besides, these other compounds

present are pyrocatechin.

The acids bear a relative pH of around 3–4 that might be the reason for the dissolution of the resin matrix leading to water sorption and further leading to color changes.

Lime is calcium oxide or calcium hydroxide and pH of the lime is around 11.8–12.4. Hence, on interaction with acid present in catechu, lime increase the pH, hence reducing acidity and increasing alkalinity.

Increase in pH does not lead to the dissolution of the resin matrix and color change. Hence, this might be reason for the less color change in catechu with lime group compared to catechu group.

As it is in vitro study, it is difficult to extrapolate the result of this study to in vivo conditions. Furthermore, the agents used in this study were used alone where as they are consumed in combination with areca nut, betel leaves, and various other constituents which might affect the results.

However, there are no studies and a very less literature available about the effect of catechu or lime on composite resins.

The literature has widely revealed the potential effects of certain food items and beverages on composite resins' surface characteristics affecting the clinician's choice of material and the patient's

control of dietary habits, but there is no report on whether or how the catechu or lime affects composite resins.

CONCLUSION:

Within the limitations of the present study, it can be concluded that all specimens showed discoloration after the completion of the test period which was visually perceptible and clinically unacceptable.

Comparing within the test solutions, catechu has shown more color change than catechu with lime at the end of 15 days.

Hence, it should be noted that the patients should be made aware about the staining characteristics of the catechu in the betel leaf preparation on tooth-colored restorations. Furthermore, clinicians should take every possible measure to aware patients about health hazards related to consumption of these substances and adverse effect on such tooth colored restorations as well.

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