



## EFFECT OF FRUIT JUICES ON COLOUR STABILITY OF NANO ZINC OXIDE COMPOSITE, NANO CALCIUM OXIDE COMPOSITE AND CONVENTIONAL COMPOSITE

N. Mohamed Arsath<sup>1</sup>, Dr. Balaji Ganesh. S\*<sup>2</sup>

<sup>1</sup>Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Chennai 600077, Tamil Nadu, India

<sup>2</sup>Reader, White Lab-Material Research Centre, Saveetha Dental College and Hospital, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai - 600077, India

**Corresponding Author: Dr. Balaji Ganesh. S**, Reader, White Lab-Material Research Centre, Saveetha Dental College and Hospital, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai - 600077, India

Email Id: balajiganeshs.sdc@saveetha.com

### ABSTRACT:

**INTRODUCTION:** Composite (Direct restorative resins ) are basically cross linked polymeric materials reinforced by a dispersion of glass, crystalline or resin filler particles or short fibre bound to the matrix by silane coupling agents. The present study aims at analyzing the effect of fruit juices on the colour stability of Nano zinc oxide composite, Nano calcium oxide composite and on conventional composite using Vita easy shade advance spectrophotometer. **MATERIALS AND METHOD:** Eight disc shaped samples of 2 mm of thickness were prepared using a customised mould. After the preparation of discs, they are numbered accordingly and color stability was measured by using Vita easy shade advance spectrophotometer, the pre and post L, a and b values were obtained. Statistical analysis such as T-test was performed with the obtained data using the statistical software “SPSS version 22”. **RESULTS AND DISCUSSION:** The values were recorded and subjected to statistical analysis for comparing the pre and post colour stability of control group, group 1 and 2 samples. The delta E values obtained depicts that there is a significant decrease in the colour stability of the Nano calcium oxide composite samples compared to conventional composite and Nano zinc oxide composite post immersion in beverages such as fruit juices. **CONCLUSION:** The current study within the limitations depict that there is a significant decrease in the colour stability of the Nano calcium oxide composite samples compared to conventional composite and Nano zinc oxide composite post immersion in beverage such as fruit juices.

**KEYWORDS:** Spectrophotometer, Colour stability, Nanocomposite

### INTRODUCTION:

Composite ( Direct restorative resins ) are basically cross linked polymeric materials reinforced by a dispersion of glass, crystalline or resin filler particles or short fibre bound to the matrix by silane coupling agents. Conventional composites consist of finely ground amorphous silica and quartz filler of size 8 to 12 micrometer(1,2). Dental composites we're developed to perform any aesthetic restorative material that simulate the natural tooth in color, translucency. Resin composite materials developed recently maintain color stability for long periods of time but initial attempts in the development of tooth colored restorative



materials depicted that the introduction of acrylic resins were weak due to discoloration, polymerization shrinkage(3,4).

Nanotechnology, the latest booming field among science and technology is basically concerned with the use of any matter on an atomic or molecular level. The concept nanotechnology was first introduced by direct manipulation of atoms by the great renowned physicist “Richard Feynman “ in the year 1959(5,6). Nanoparticle refers to the atoms or any matter with at least one dimension sized from 1 to 100 meters. Implementation of nanotechnology principles or method in the field of medicine revolutionized entirely with the possibilities such as molecular level therapy, drugs formulation with higher degree of cell specificity by incorporating natural herbs used in the traditional folk medicine. Implementation of nano principles in the field of dentistry led to the development of nanocomposite, Nanoparticle formulated mouthwash(7,8).

In recent times various studies comparing the colour stability of Cention N composite, micro filled composite, hybrid composite and finally nanocomposite were conducted. The present study aims at analyzing the effect of fruit juices on the colour stability of Nano zinc oxide composite, Nano calcium oxide composite and on conventional composite using Vita easy shade advance spectrophotometer.

**MATERIALS AND METHOD:**

**Sample preparation:** The study was done at White Lab, Saveetha Dental College and Hospital, Chennai, India. In this study, conventional composite is taken as the control group and Nano zinc oxide composite (group A), Nano calcium oxide composite (group B) is taken as the test groups. Eight disc shaped samples of 2 mm of thickness were prepared using a customised mould. 4 samples in control group( sample 1-4), 2 samples for test group A( sample 5-6) and 2 samples for test group B(sample 7-8).

**Pre Immersion color stability testing:** After the preparation of discs, they are numbered accordingly and color stability was measured by using Vita easy shade advance spectrophotometer, the pre colour value was taken. L, a and b values were obtained prior to Immersion.

**Post Immersion color stability testing:** The colour stability value of the prepared discs after immersion was again determined using the vita easy shade spectrophotometer. L, A and B values are noted.

**Statistical Analysis:** The colour stability values prior and after immersion were obtained , with the obtained values an descriptive analysis test such as “t test” was performed using the statistical software “SPSS VERSION 22 “ and the final result of the analysis test carried out was depicted in the form of a bar graph.

**RESULTS AND DISCUSSION:**

Table 1: Table depicts the L, A, B values before immersing the samples in fruit juice

Samples	L value	a value	b value
1	76.2	1.4	14.6



<b>2</b>	<b>77.1</b>	<b>1.1</b>	<b>13.9</b>
<b>3</b>	<b>78.6</b>	<b>1.3</b>	<b>14.6</b>
<b>4</b>	<b>75.1</b>	<b>0.9</b>	<b>12.5</b>
<b>5</b>	<b>69.1</b>	<b>1.0</b>	<b>12.9</b>
<b>6</b>	<b>73.4</b>	<b>1.0</b>	<b>12.2</b>
<b>7</b>	<b>76.9</b>	<b>1.4</b>	<b>14.0</b>
<b>8</b>	<b>76.1</b>	<b>1.5</b>	<b>15.2</b>

Table 2: Table showing post LAB values after removing samples from fruit juice

<b>Samples</b>	<b>L value</b>	<b>a value</b>	<b>b value</b>
<b>1</b>	<b>61.1</b>	<b>2.0</b>	<b>13.3</b>
<b>2</b>	<b>69.0</b>	<b>2.0</b>	<b>13.7</b>
<b>3</b>	<b>58.0</b>	<b>2.1</b>	<b>12.5</b>
<b>4</b>	<b>62.0</b>	<b>1.8</b>	<b>12.3</b>
<b>5</b>	<b>57.4</b>	<b>1.4</b>	<b>11.6</b>
<b>6</b>	<b>55.8</b>	<b>1.6</b>	<b>10.1</b>
<b>7</b>	<b>66.7</b>	<b>1.6</b>	<b>12.3</b>
<b>8</b>	<b>67.8</b>	<b>1.9</b>	<b>11.3</b>

Table 3: Table showing delta E value of each sample

<b>Samples</b>	<b>Delta E value</b>
<b>1</b>	<b>15.59</b>
<b>2</b>	<b>8.15</b>
<b>3</b>	<b>20.72</b>



<b>4</b>	<b>13.13</b>
<b>5</b>	<b>11.78</b>
<b>6</b>	<b>17.74</b>
<b>7</b>	<b>10.34</b>
<b>8</b>	<b>8.80</b>

**Table 4:** Represents the mean, standard deviations of the control and test groups obtained from pre-immersion and post-immersion values. The significant difference was  $0.15 > 0.05$  ( statistically insignificant)

<b>GROUP</b>	<b>N</b>	<b>MEAN</b>	<b>STD.DEVIATION</b>	<b>P VALUE</b>
<b>conventional composite</b>	4	14.39	5.22	0.15
<b>Nano Zinc oxide composite</b>	2	14.76	4.21	
<b>Nano Calcium oxide composite</b>	2	9.57	1.08	

Table 1 shows the pre values of L,A and B of samples before immersing the samples in fruit juices. The L,A and B value for sample 1 is 76.2, 1.4 ,14.6 and for sample 2 is 77.1, 1.1, 13.6. The L,A and B values for sample 3 is 78.6, 1.3, 14.6 L,A and B values for sample 4 is 75.1, 0.9, 12.5 , for sample 5 the values are 69.1, 1.0, 12.9 and for sample 6 the values are 73.4, 1, 12.2. The L,A and B value for sample 7 is 76.9, 1.4, 14.0 and for sample 8 the values are 76.1, 1.5, 15.2. In Table 2 it shows the post values of L,A and B of samples. The L,A and B value for sample 1 is 61.1, 2, 13.3 and for sample 2 it is 69, 2, 13.7 . The L,A and B values for sample 3 are 58.0,2.1, 12.5 and for sample 4 it is 62.0, 1.8, 12.3 , for sample 5 the values are 57.4, 1.4, 11.6 and for sample 6 the values are 55.8, 1.6 , 10.1. The L,A and B value for sample 7 is 66.7,1.6 ,12.3 and for sample 8 the values are 67.8, 1.9, 0.1.

In Table 3 it shows the delta E value of each sample. The delta E value of sample 1 is 15.59 and for sample 2 it is 8.15 and for sample 3 it is 20.72, sample four it is 13.13 and for 5th sample it is 11.78 and for sixth it is 17.74. The delta E value of the seventh sample is 10.34 and for the eight value it is 8.80. Table 4 depicts the mean and standard deviation of conventional composite as 14.39 and 5.22 respectively. The mean and standard deviation of nano zinc oxide composite was 14.76 and 4.21respectively. The mean and standard deviation of nano calcium oxide composite was 9.57 and 1.08 respectively.Mean ΔE value was higher for conventional and nano zinc oxide composite samples when compared to nano calcium oxide oxide composite samples (Figure 1). Thus, nano calcium oxide composite possesses less color stability compared



to other composites. The p value obtained was 0.17 which is more than 0.05, thus indicating statistically insignificant.

An important property of restorative materials is color stability. For assessing chromatic differences the American Dental Association suggests using CIELAB colour coding system(9,10). In the current study, colour evaluations was made by using the spectrophotometer and CIELAB coding system as it was found useful in providing information about the colour terms of 3 coordinate values L\*, a\* and b\* where L\* represents the value of brightness and a\* and b\* represents the numeric correlates. The magnitude of colour difference  $\Delta E$  obtained from these values to assess the change in the colour stability. It was found that greater the  $\Delta E$  value, higher is the difference between the pre and post colour stability with regards to colour stability.

An in vitro study conducted by Meena, K., et al on analysing the Color Stability of Posterior Nanocomposites Treated with Colored Beverages after Brushing and Thermocycling concluded that the color stability of the composite materials depended on the type of beverages exposed, exposure time, composition of the tested composite material and the colour stability reduces upon time(11).The current study results were similar to the previous study results,in the current study nano calcium oxide composite colour stability has reduced a lot compared to the other tested groups.

Study conducted by Karadaş, Muhammet, and Sezer Demirbuğa in 2017 state that Microhybrid and nanohybrid SonicFill with higher filler amounts revealed more surface deterioration which is similar to the current study results(12).

Previous study results showed invariably that all soft drinks resulted in clinically unacceptable discoloration of the composite materials with maximum discoloration being that following immersion of composite materials.The current study also hold true with this findings,invariably colour stability of all tested groups has reduced upon immersion.(13)

### **CONCLUSION:**

It is evident from this study that beverages like fruit juices posses an equal effect on the colour stability of different categories of composite material such as conventional composite,Nano composites,within the limitations present in this study we can conclude based on the delta E values obtained that there is a significant decrease in the colour stability of the Nano calcium oxide composite samples compared to conventional composite and Nano zinc oxide composite post immersion in beverage such as fruit juices.

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### **CONFLICT OF INTEREST:**

All the authors declare no conflict of interest in the study.

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**REFERENCE:**

1. de Oliveira NG, Espíndola-Castro LF, Rocha JC, de Barros Albuquerque AP, de Melo Rêgo MJB, de Melo Monteiro GQ, et al. Influence of the self-adhering strategy on microhardness, sorption, solubility, color stability, and cytotoxicity compared to bulk-fill and conventional resin composites. *Clin Oral Investig* [Internet]. 2022 Aug 2; Available from: <http://dx.doi.org/10.1007/s00784-022-04624-5>
2. Andrade ACM, Borges AB, Kukulka EC, Moecke SE, Scotti N, Comba A, et al. Optical Property Stability of Light-Cured versus Precured CAD-CAM Composites. *Int J Dent*. 2022 May 31;2022:2011864.
3. Al-Yakoubi Y. Color Stability of Light-activated Bleach Shade Composites. 2010. 152 p.
4. Vice HD. Color Stability of Light-cured Composite Materials. 1984. 80 p.
5. Zhou Y, Ding G. *Polymer Nanocomposite Materials: Applications in Integrated Electronic Devices*. John Wiley & Sons; 2021. 304 p.
6. Twardowski TE. *Introduction to Nanocomposite Materials: Properties, Processing, Characterization*. DEStech Publications, Inc; 2007. 569 p.
7. Pramanik A, Basak A, Dong Y, Prakash C, Paulo Davim J. *Nanocomposite Manufacturing Technologies: Fundamental Principles, Mechanisms, and Processing*. Woodhead Publishing; 2022. 600 p.
8. Öchsner A, Ahmed W, Ali N. *Nanocomposite Coatings and Nanocomposite Materials*. Trans Tech Publications Ltd; 2009. 402 p.
9. Seghi RR, Hewlett ER, Kim J. Visual and instrumental colorimetric assessments of small color differences on translucent dental porcelain. *J Dent Res*. 1989 Dec;68(12):1760–4.
10. Ruyter IE, Nilner K, Moller B. Color stability of dental composite resin materials for crown and bridge veneers. *Dent Mater*. 1987 Oct;3(5):246–51.
11. Website [Internet]. Available from: [http://dx.doi.org/10.4103/jioh.jioh\\_268\\_19](http://dx.doi.org/10.4103/jioh.jioh_268_19)
12. Karadaş M, Demirbuğa S. Evaluation of color stability and surface roughness of bulk-fill resin composites and nanocomposites. *Meandros med dent j*. 2017 Dec 1;18(3):199–205.
13. Al-Haj Ali SN, Alsulaim HN, Albarrak MI, Farah RI. Spectrophotometric comparison of color stability of microhybrid and nanocomposites following exposure to common soft drinks among adolescents: an in vitro study. *Eur Arch Paediatr Dent*. 2021 Feb 10;22(4):675–83.