Comparative evaluation of colour stability of bulk fill and flowable composite restorative material before and after immersion in different fruit juices

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Abstract:

Introduction: Composite restorations are widely used as an esthetic restorative material in anterior and posterior teeth. Composite resin should retain the color and polish over a long period to serve as a long-term esthetic restorative material.Color stability is the ability of any dental material to be able to retain its original color. The oral cavity has a dynamic environment. With the continuous presence of microflora, saliva, and frequent intake of colored food, the color stability of an esthetic material may become compromised. However, the property of color stability of esthetic dental materials is often ignored over other physical and mechanical properties while making a choice. The aim of the present study is to evaluate the color stability of bulk fill and flowable composite restorative materials before and after immersion in different fruit juices.

Materials and methods: Sixteen samples of composite filling material among which 8 samples prepared were from bulk-fill type and 8 were prepared from flowable composite type for the in vitro study. Disc-shaped specimens were prepared from each group. Then the eight samples were subjected to a color stability analysis before and after immersion in lemon and grape juices. **Results:** The mean value of tetric N-ceram [Bulk composite] is 9.4415 and Nexcomp [Flowable composite] is 8.4175. T-test was done and was found to be statistically insignificant [p value: 0.348 (>0.05)] **Conclusion:** From this study, it is evident that flowable composite material had better color stability than bulk fill composite after immersion in lemon and grape juices.

Keywords: Color stability; Fruit juice; Invitro study; Spectrophotometer, Composite resin, Innovative measurement

Introduction:

The color stability of resin composite materials is crucial for esthetic restorations and it can be one of the most common reasons for restoration replacement. Bulk-fill resin composites are light-cured resin composites that can be placed in increments or layers of 4 to 5 mm in depth. Composite resins

are the primary material for the direct restoration of posterior teeth because of their clinical applicability, physical and mechanical properties, adhesion to tooth structure, and moderate cost(1). These materials are in a constant process of chemical degradation in the oral cavity due to diets that contain a variety of colored and acidic drinks. Effects such as the alteration of color and surface roughness and the decreased microhardness on composite resins after in vitro exposure have also been demonstrated(2). In addition, fresh juices can alter the color of composite resins through the absorption and adsorption of colorants during the period of exposure(3). Inadequate adaptation leads to tooth restoration interface microcracking, postoperative sensitivity and microleakage. Secondary caries is a clinical sign associated with the polymerization shrinkage stress of composite resins(4).

Color stability has therefore been considered as one of the most important factors when selecting composite resin materials for aesthetic restorations. Assessment of color stability and discoloration has also been included in commonly used outcome measurement tools that rate the success and failure of composite resin restorations in clinical practices(5). Discoloration of composite resins can be caused by internal or external factors. Internally induced discolorations are permanent and are related to polymer quality, filler type and amount, as well as the synergist added to the photoinitiator system(6). In light-cured composite resins, if curing is inadequate, unconverted camphorquinone will cause a yellowish discoloration. Besides the obvious effects of colorants in beverages, extrinsic discoloration is also clearly associated with the chemical, physical and structural properties of the composite resin materials(7).

Compositions of the resin matrix affect water sorption, solubility, hydrophilicity and microstructures of the composites, which may dictate the long term color stability of the composite resin restorations(8). Composite resins with high water sorption and hydrophilicity are more susceptible to discoloration as colorants are likely absorbed with water into the resin matrices(9). It has also been speculated that the inorganic fillers in the composite materials affect color stability as their size, type, distribution and affinity with resin matrix may influence adsorption and absorption of colorants to composite materials(10). Though numerous experimental models have been used to study the color stability and stain resistance of composite resin materials, few have

differentiated adsorption in terms of their relative contributions to discoloration(11). Most color stability study models involve immersion of composite resin discs in static colorant beverages at 37 degree celsius for a lengthy period of time and measure the color changes following a simple rinse of the discs. Furthermore, few studies have considered the thermal stress and pH environments of the oral cavity during consumption of colorant containing beverages(12). Both thermal stress and pH variations may affect the surface and structural integrities of composite resin materials and render the restorations more susceptible to staining and discoloration(13,14). As experimental testing in vitro remains to be a vital tool in assessing the color stability and stain resistance of new aesthetic restorative materials, it is important to devise a new model that considers the effects of thermal stress, pH variation, complexity of dietary colorants, and dynamic nature of fluid flow and allows differentiation of adsorption from absorption(15,16). The aim of the present study is to evaluate the color stability of bulk fill and flowable composite restorative materials before and after immersion in different fruit juices.

Materials and methods:

Preparation of specimen:

For performing this study, two composite of two different brands were used. One type of Nexcomp [Flowable composite] Other being N-ceram [Bulk composite]. A disc was made using a circular mold of standard diameter of 10mm and thickness of 2mm, which is made up of additional silicone material. The composite material was placed and UV light cure was done for 30 seconds. Then the specimen was removed from the mold and smoothen up by using conical bur. Likewise, 8 specimens for each composite were made.

Immersion in fruit juices:

For comparing the color stability of the two types of composites, 2 fruit juices were used (Grape juice and lime juice). The 16 test groups of composite bars were separated into 2 set batches (8+ 8) for immersion in 2 juices. Each group consisted of 8 specimens (bulk-fill composite and flowable composite). A one week regimen was followed for immersion. For a day, the 2 sets of composites were immersed for at least 10 minutes, once in the morning and evening. The samples were thoroughly washed and dried completely after immersion.

Determination of color stability:

L,a,b values were collected from a vita easy shade spectrophotometer. Then, we calculate Delta E values for the comparison between before and after immersion in different medium that is fruit juices.

Results:

The present study assessed the color stability of different composite restorative materials of before and after immersion in different fruit juices. In Table 1; The delta E mean value of color stability of tetric N-ceram [Bulk composite] immersed in lemon juice is 9.27 whereas ,the delta E mean value of color stability of tetric N-ceram [Bulk composite] in grape juice is 9.60. The delta E mean value of color stability of Nexcomp [Flowable composite] immersed in lemon juice is 8.55 whereas ,the mean delta E Value of color stability of Nexcomp [Flowable composite] immersed in grape juice is 8.27. Table 2: The table representing significant testing between the groups. The mean value of tetric N-ceram [Bulk composite] is 9.4415 and Nexcomp [Flowable composite] is 8.4175. The standard error mean value of tetric N-ceram [Bulk composite] is 4.00510 and Nexcomp [Flowable composite] is 2.92106.

Figure1 is the bar graph showing association between the colour stability of bulk fill and flowable composite resin and mean value. Flowable composite material had better color stability than bulk fill composite material. T-test was done and was found to be statistically insignificant [p value: 0.348 (>0.05)]

Table 1: The table shows the average delta E values of two different brands of composite tetric N-ceram [Bulk composite] and Nexcomp [Flowable composite] when immersed in lemon juice and grape juice.

S:No	Different Types of composites	DeltaE Mean value
1	Bulk composite in lemon juice	9.27
2	Bulk composite in grape Juice	9.60
3	Flowable composite in lemon juice	8.55
4	Flowable composite in grape juice	8.27

Table 2: The table representing significant testing between the groups.

Groups	Mean	Standard error mean	Standard deviation	significance
tetric N-ceram [Bulk composite]	9.4415	4.00510	0.839	0.348
Nexcomp [Flowable composite]	8.4175	2.92106	0.840	0.348

Independence sample t-test used p-value is [0.348(>0.05)]

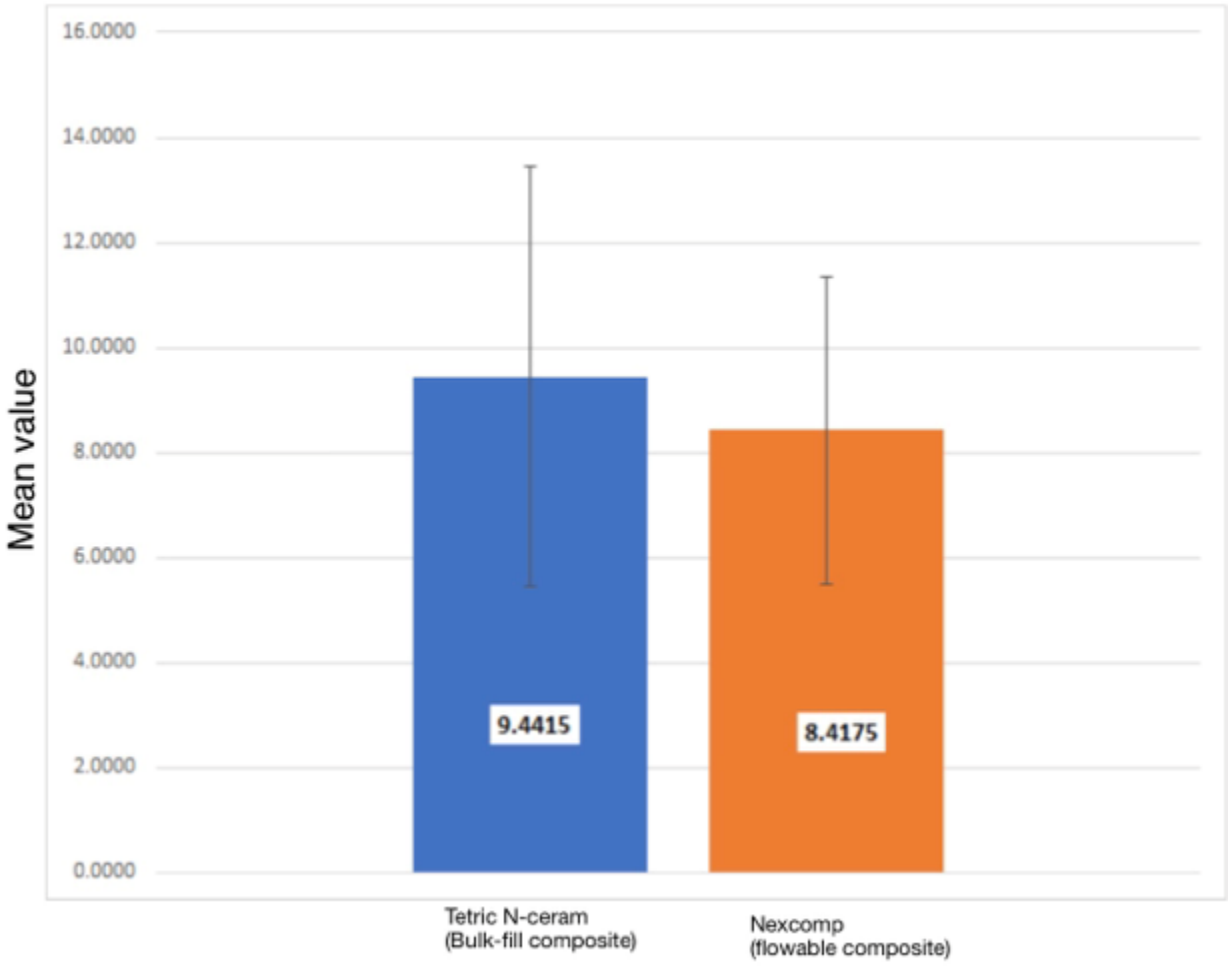

Figure 1: The graph shows the association between the colour stability of bulk fill and flowable composite resin and mean value. The blue color represents tetric N-ceram [Bulk composite] and orange color represents Nexcomp (flowable composite). The X axis represents composite material and Y axis represents mean value. Flowable composite material had better color stability than bulk fill composite material. T-test was done and was found to be statistically insignificant [p value: 0.348 (>0.05)]

Discussion:

The present study assessed the color stability of different composite restorative materials before and after immersion in different fruit juices. One study evaluated the color change of three types of composite resins exposed to coffee and cola drink, and the effect of repolishing on the color stability of these composites after staining. They found out greater colour changes with different beverages, which is similar to our study. (17,18) Five composite materials (Filtek Z350, Filtek Bulk-Fill, Tetric N-Ceram Bulk-Fill, Sonic Fill 2, and SDR) were investigated by Bahbishi N et al in a study, where they analysed the color stability of aesthetic restorative materials after exposure to commonly consumed beverages and analysed that less colour changes in different beverages, which is not similar to present study. Based on this investigation and previous ones, it can be concluded that darker solutions can produce more color changes.(19,20) This can translate clinically into more chances for color changes of composite restorations in patients whose diets contain dark beverages such as tea, coffee and red wine.(21)

The effect on colour stability of composite resins depends on type of solution, exposure time and composition of material, which the statement proved in a present study.(22) Silva HA et al evaluate and compare the effect of grape derived beverages in colour stability of composite resin submitted to different finishing and polishing methods. White drinks are alternatives to color stability of composite resin. In the study time, composite resin demonstrated progressive discoloration when immersed in red wine and red juice. On the other hand, samples submitted to white beverages showed higher color stability.(23) The discolouration of tooth coloured bulk filling composite and normal composite materials can be an extensive reason for the replacement of dental restoration in aesthetics(24).

Colour stability has already been studied in vitro for a range of aesthetic restorative materials. Several studies have reported that fresh juices further dye by softening the resin matrix of the composites. Vita EasyShade Spectrophotometers are adapted to detect colour differences below the threshold of visual perception . The value of Delta E represents relative colour changes that an

observer efficacy reports for materials after immersion or between time periods. Thus Delta E is more relevant than the individual L*, a*, b* values (25). Among the two different composite bulk fill composites have shown a greater discoloration than flowable composite in the present study. Limitation of the present study is the few sample sizes. In the future, clinical in vivo studies can be done by comparing the color efficacy of various composite materials

Conclusion:

From the present study, we can conclude that flowable composite material had better color stability than bulk fill composite material after immersion in lemon and grape juices.

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Conflict of interest:

The authors declare that there was no conflict of interest.

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