

Comparison Of Colour Stability Of Two Commercially Available Composite Resin Materials After Thermocycling - An *In Vitro* Study

Research Article

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Abstract

Introduction: The colour stability of composites are important because of the aesthetic purposes. Composites are the large amorphous substance of quartz and silica. Composite offers excellent performance material for both anterior and posterior direct replacement restoration. Thermocycling requires a constant temperature in a water bath. The cycle influences the alternate high and low temperatures. This study aims to analyse the effect of thermocycling on colour stability of 2 commercially available composite restorative materials.

Materials and Method: 2 different brand composite was selected. For this study, Te-Econom plus and Restofill were taken. Putty made of disc 1-2 mm was prepared and the composite was moulded into disc shaped and light cured. For each composite, 10 samples were made. The samples were placed in the thermocycler where 1000 cycles were done equating 6 months. The thermocycler used was CS4.4 -SD Mechatronik. Before and after thermocycling, color stability was observed using the spectrophotometer (Vita easy shade advance) and the results were tabulated.

Result: Te-Econom plus samples had less delta e values when compared to restofill brand samples. T test was done and the p-value is found to be 0.550, hence not statistically significant.

Conclusion: It can be concluded that Te-Econom plus was found to have a greater colour stability than the Restofill brand after thermocycling.

Keywords: Thermocycling; Colour Stability; Composite Resin; Spectrophotometer; Innovative Technology.

Introduction

Composite materials are widely used these days and more than 90% of the restoration is done by composite materials [1]. They are the synthetic material that combined with dispersion of glass, mineral or resin filler particles. These cements are used in the crown cementation. The traditional composite are large particles of ground amorphous silica and quartz. Composite can be classified as chemically activated resin and photochemically activated resin [2]. They succeed in modern biochemical research. Composite materials are composed of 3 phases- polymerizable resin,

filler and the filler-resin interphase [3]. The composite resin offers excellent performance material for both anterior and posterior direct placement restoration [4].

Thermocycling is a combined method of hydrolytic and thermal degradation and required for any kind of temperature related breakdown. Thermocycling requires a medium to maintain a constant temperature in a water bath. The specific standards, immersion times and temperature to establish the test. It is mainly based on the diffusion of heat and also moisture to test the specimen according to the criteria provided [5]. Thermocycling is most ef-

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fective in the aging process. The cycle is influenced by the flow of alternate high and low temperatures [6]. According to the previous study, Ozel conducted a study on composite material which was treated with resin to bur and laser [7]. Thermocycling of the composite by analysing and comparing the CIELAB ΔE^* and CIEDE2000 colour difference. The colour was measured by spectrophotometer relative to the standard illuminant that was available called D65 over a white background [8].

The study conducted by wahab, was on the effectiveness of thermocycling on the microleakage of the several commercially available composites in vitro. This study investigated 120 molars where class 5 cavities were prepared and restored using 6 different composites that were commercially available. Then divided randomly into 3 groups where one group undergoes thermocycling with 500 cycles of 5°C and 55°C and the other group with no thermocycling. It was found that thermocycling increased the microleakage [9]. In the study conducted by Isil Gurdal, he compared the composites colour and the CAD-CAM materials using the thermocycling process during the aging procedure. ΔE value was also calculated for the composite resin and the p value was generated. He concluded that the composite resin influences the change in colour during the aging process [10].

In the study conducted by JCC Yuan, where he analysed the colour stability of different CAD-CAM ceramic restoration under thermocycling. The ceramics were classified into 9 different groups and the thermocycling was done on 6000, 12000 and 18000 cycles replicating the oral environment of 5, 10 and 15 years. The colour difference (ΔE) value was calculated and analysed using 2-way ANOVA. The lithium disilicate CAD and zirconia ceramics were found to have ΔE value of 2.5 [11]. From the studies conducted, it was observed that thermocycling was done to check the various parameters and negligible studies were done on the comparison of colours between the 2 composite materials. This study aims to analyse the effect of thermocycling on colour stability of 2 commercially available composite restorative materials.

Materials and Methods

Sample preparation:

2 different brand composite was selected. For this study, Te-Econom plus and Restofill were taken. Putty made of disc 1-2 mm was prepared and the composite was moulded into disc shaped and light cured. For each composite, 10 samples were made.

Pre-color testing:

After the preparation of discs, they are numbered accordingly and brand name Te-Econom plus and Restofill was mentioned carefully and by using Vita easy shade advance spectrophotometer, the pre colour value was taken.

Packing:

Using a cotton gauze, the sample was covered and made into small balls using rubber elastics and extra gauze was cut. Colour coding was done to avoid confusion. The sample was then carried to a chewing simulator where thermocycling was done.

Thermocycling:

The samples were placed in the thermocycler where 1000 cycles were done equating 6 months. The temperature was 10°C when cold and 60°C when hot. The dwelling time was found to be 30 seconds and the draining time was 10 seconds. The thermocycler used was CS4.4 -SD Mechatronik (Figure 1).

Post-colour:

After the thermocycling was done, the color was observed using the spectrophotometer (Vita easy shade advance) and the results were tabulated.

ΔE value and the mean value was calculated and p value of the same was generated using SPSS software. The results obtained were then compared for the pre and post colour after thermocycling of the 2 different composites.

Results

From the results obtained it was found that 2 different graphs were obtained. Table 1 represents the delta E value of the 2 commercially available composites. The values of the 10 samples of restofill being 5.424, 9.529, 12.66, 15.04, 8.779, 7.656, 10.49, 8.744, 10.20 and 8.86. The values for te-econom plus being, 3.277, 3.636, 6.027, 3.382, 18.45, 4.839, 3.055, 3.513, 4.692 and 5.941. Table 2 shows the standard deviation, p values and mean of the 2 commercially available composites. The p-value was found to be 0.550, the p-value being greater than 0.05, the p-value is insignificant. The mean value of the composites restofill and te-econom plus are 9.74320 and 5.68120 respectively. The standard deviation of restofill is 2.658911 and for te-econom plus is 4.615969. Figure 1 shows the comparative delta E values of the two commercially available composites.

Figure 1. Showing the thermocycling of the samples in the chewing simulator. Thermocycling was done alternatively at hot and cold temperatures (5°C and 55°C).



Table 1. Showing the mean ΔE value of the 2 commercially available composites.

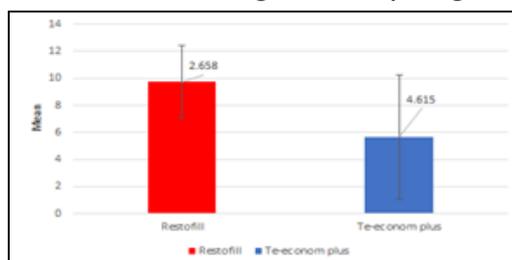
SAMPLE	RESTOFILL	TE-ECONOM PLUS
1	5.424	3.277
2	9.529	3.636
3	12.66	6.027
4	15.09	3.382
5	8.779	18.45
6	7.656	4.839
7	10.49	3.055
8	8.744	3.513
9	10.2	4.692
10	8.86	5.941

Table 2: Showing the mean, standard deviation and significance values for restofill and Te-econom plus composites.

GROUPS		N	MEAN	STANDARD DEVIATION	SIGNIFICANCE
Delta E	Restofill	10	9.743	2.659	0.55
	Te-econom plus	10	5.681	4.616	

Unpaired t-test was used to find the significance. P-value less than 0.05 was considered to be significant.

Figure 2. Bar graph showing the mean delta E values and standard deviation of restofill and Te-econom plus where the red bar represents the restofill composite and the blue bar shows the Te-econom plus composite. X-axis represents the 2 commercially available composites and Y-axis shows the mean value of the same. It can be inferred that te-econom plus showed more colour stability when compared to restofill composite. Unpaired t-test was done. The p-value was found to be 0.550, greater than 0.05, showing statistically insignificant.



Discussion

Our team has extensive knowledge and research experience that has translated into high quality publications [12-31]. Composite is a compound that is composed of resins and it can be light cured. It is a major component that is involved in dentistry. Thermocycling is one of the processes that is involved in calculating many parameters such as aging, colour etc. This study mainly focused on the colour of the composite before and after thermocycling. The study conducted by Yasemin et al, had calculated the colour stability of different resin material which was subjected to thermocycling and the mean value of the materials PMMA was found to be 0.69, the white acetal resin was found to be 0.74 and pink acetal resin was found to be 0.77 on exposure to 100 hours. Similar results were found in this study where the mean value of the samples have been mentioned [32]. The colour stability of three different types of composites was evaluated in a study proposed by Yan Fang Ren et al immersing the discs of the sample in three different liquids and the ΔE values were compared. The ΔE values corresponded to 5.74 for FiltekSU, 3.21 for TPH3 and 2.52 for Renamel [33].

In the study conducted by Swastika battacharya, the samples immersed in water, prior to testing the colour, were prepared for thermocycling and the corresponding ΔE values were measured. The ΔE values for Group I corresponded to 1.01 ± 0.79 and 2.15 ± 0.71 after 250 to 500 cycles, Group II values corresponded to 1.36 ± 0.29 and 3.60 ± 0.84 while Group III was found to be 1.32 ± 0.50 and 2.55 ± 0.62 [34]. To identify the colour stability properties of the different dentin bonding techniques in composite resin luting cements, a study was conducted by Haralur SB et al. the composites were divided into different groups based on the shade of the teeth, assessed using a spectrophotometer before and after subjection to the accelerated ageing process. Thermocycling at 5°C and 55°C at 5000 cycles for 100 hours was fixed as the standard ageing process. Based on the values recorded, it was concluded that group 2 and group 4 composites were resistant to colour change [35].

A study proposed by Arregui et al explained the colour stability of 2 self adhesive composite and 4 methacrylate-based composites before and after storage in water. The delta E values were recorded after submerging the composites for 30 days. It was concluded

that water had no effect on the colour change [36]. The study on the colour stability comparison of the flowable composite was done by Yu et al, where the 5 samples of each composite were taken and it was subjected to artificial aging such as thermocycling to observe the colour change. It was noted that flowable composites showed maximum colour change [37]. The present study however puts forth limitations such as restricted sample size and types of composites used but paves way for advanced research on the same eliminating the limitations of the present study.

Conclusion

It can be concluded that thermocycling has an effect on the color stability and henceforth it can be stated that the composite brand Te-Econom plus was found to have a greater colour stability than the Restofill brand.

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