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Comparıson Of Coloratıon Of Composıte Resın Restoratıons As A Result Of Waıtıng For Dıfferent Solutıons

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Abstract: *Objective: The aim of this study was to evaluate the effect of different times and exposure time of different solutions on coloration.*
Material and Method: In this study, 60 pieces of 13 mm diameter and 1.5 mm thick composite blocks were used. Five different solutions (tea, coffee, cola, red wine and distilled water) were used for the staining procedure. Samples were analyzed by using spectrophotometer and color changes according to the time and solutions they were kept in the solutions. Color values of each sample kept in solutions for 30 days. 1, 2, 7. On the 21st and 30th days, the color change values (ΔE00) were calculated. Statistical analyzes were performed by comparing the ANOVA in multiple groups with the Bonferonni test in paired comparisons, when the mean values of the data provided normal distribution. Kruskall Wallis and Mann Whitney-U test were used for nonparametric conditions
Results:In the study, the differences of the samples according to the days and the solutions used were not statistically different between the coloration measurements of the water from day 1 to day 30 (p = 0.205). In all other solutions, the colorings increased with time. After 30 days, all mean measurements were statistically increased in tea, instant coffee, cola and wine solutions (p <0.001).
Conclusion: The color of the samples kept in colorant solutions increased with time. The highest coloration of wine in distilled water while the samples are kept in time showed no statistical difference in color.
Keywords: *Coloration, composite, solution*

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I.Introduction

In today's dentistry restoration of the tooth tissue with the least possible loss of aesthetic and function is intended to be as high as possible. Composite restorations are almost reliable and up-to-date aesthetic restorations that have completely replaced the amalgam. Composite resin materials are translucent and have a tooth color.

The terminological meaning of the word şekil composites olarak means the products formed by combining at least two different materials with different structure and characteristics to form distinct phases [1,2].

It is possible to define the composite material as a three-dimensional mixture of at least two different materials in current dentistry. By combining two or more materials with different structure and characteristics, it is aimed to develop a new material with the characteristics they cannot have on their own [1,2].

In 1962, composite resins were firstly introduced by Buonocore in 1955 [3], after the application of acid for 30 seconds with 85% phosphoric acid to the enamel surface. Ray Bowen has made great progress since they are described [4].

Obtaining natural-looking dental restorations is an important goal for dentists [5]. In order to simulate the natural appearance of the tooth in restorations, materials and layering techniques are required in different colors and opacities. Newly developed materials allow the complex anatomy and optical properties of the tooth to be applied to restorations [6].

Effective polymerization of composite resins is of great importance in the clinical success of composite resin restorations. It is stated that the polymerization affects the corrosion resistance, surface hardness, biocompatibility, residual monomer content and water absorption of composite resins [7,8].

Color Stability

In today's dentistry, the development and strengthening of both physical and aesthetic properties of composite resins has been widely used. Aesthetic restorative materials should be able to mimic the appearance of natural teeth and this is directly related to the color matching and color stability of the material [9].

The most important disadvantage of composite resins is the coloration of composite resins over time. The most important reason for the renewal of aesthetic composite resin restorations, especially in the anterior region, is the discoloration of the restorations in time [10-14].

The restorative materials used to provide an ideal smile and patient satisfaction should have internal color stability and should be resistant to surface discolorations over time [15].

Color stability in composite resins has been reported to be related to the size of the resin matrix, the size of the filler particles, the depth of polymerization and the type of coloring agents [16].

Satou et al. (1989), in hydrophilic solutions, explained that the coloration process of composite resins is related to water absorption and hydrogen bonding. In hydrophobic staining solutions, the contact angle with the resin surface plays an active role in coloration [17].

The degree of color change of composite resins may be affected by many factors such as insufficient polymerization, water absorption, poor diet, poor oral hygiene and surface roughness of restoration [18].

Coloring of composite resins is divided into two groups:

- External coloration
- Internal coloration

External Coloration

Depending on the individual's habits, the colorations caused by plaque and color pigments accumulated over time in the surface of composite resin restorations are called external colorations [19-21].

In addition, the surface roughness of the composite resin restoration and the incorrect finishing and polishing processes are also effective in the formation of external coloration [20]. Some studies indicate that surface roughness in composite resin restorations is directly related to coloration [21]. By the chemical dissolution of the composite resin surface, the addition of coloring agents to the surface may cause discoloration [1, 7, 22].

Internal Coloration

It is a physico-chemical reaction due to the color of the composite resin due to its structure. Internally colored colorations are affected by many factors such as resin matrix content, filler particle size and ratio, light-sensitive initiator type, binding agent color [23-25].

The lower the viscosity of the composite resins found in the UDMA and the less water absorption, the less coloration of these composites [23-25].

The susceptibility of resin composites to coloration depends on the water absorption and hydrophilic nature of the resin matrix. If the matrix absorbs water, other colorant liquids are also absorbed. This results in coloration in composite resin restorations [15].

II. Materials and Methods

In this study, it was aimed to evaluate the color changes in composite resin discs by keeping the aesthetic composite material in different colorant solutions for 30 days.

In this study, Filtek ™ Z550 Nano Hybrid Universal is used as restorative filler material. The filler was selected in A1 color. 5 different solutions were used to color the restorative materials: distilled water, tea, instant coffee, cola and red wine. All materials and manufacturers used for this study are given in Figure 1. The devices used are shown in Figure 2.

Figure 1: Table of materials and manufacturers used in the study

Materiel	Product	Manufacturer
Composite Resin	Filtek™ Z550 Nano Hybrit Üniversal (A1 Color)	3M ESPE, St Paul MN, ABD
Polishing Disc	Optidisc Polishing Disc	Sds Kerr Danbury, CT, USA.
Colorant Solution	Yellow Label Black Tea	Lipton, Türkiye
Colorant Solution	Nescafe 3 in 1	Bursa, Türkiye
Colorant Solution	Coke	The Coca-Cola Company, Türkiye
Colorant Solution	Red Wine	Dikmen, Kavaklıdere, Ankara, Türkiye

Figure 2: Table of devices and manufacturers used in the study

Device	Brand and Model	Manufacturer
Light device	3M Espe Elipar S10	3M ESPE, St Paul MN, ABD
Spectrophotometer	Lovibond RT Series	The Tintometer® Group, Lovibond House, UK

Preparation of Samples

In our study, a polytetrafluoroethylene mold having a diameter of 13 mm and a thickness of 1.5 mm was used. A total of 60 samples were prepared. Filtek ™ Z550 Nano Hybrid Universal with A1 color was used as composite material. During the preparation of the samples, the composite material was applied to the disc-shaped spaces in a single layer and the transparent tape and the cement glass were placed. By applying light pressure, the excess material was overflow and a smooth surface was obtained. A slowly increasing composite was taken with a mouth spatula and then light-treated with a light intensity of 1200 mW / cm2 (3M Espe Elipar S10, Dental Products, St. Paul, MN, USA) was polymerized for 20 minutes according to the manufacturer's instructions. After the polymerization was completed, both surfaces of all samples were polished with polishing discs (Optidisc Polishing Discs, Sds Kerr Danbury, CT, USA.) for a period of 60 seconds at a low speed, with a mild pressure, clinical contraindication and micromotor. An equal number of samples were separated for each solution and groups were formed (n = 12).

After the samples were divided into groups, the initial color measurements were made in the distilled water at 37 ° C for 24 hours. Measurements were made with Lovibond brand spectrophotometer. After initial measurements were made, samples were placed in coloring solutions.As a coloring solution; distilled water, tea (yellow label tea, Lipton, Turkey - prefabricated a tea bag, was allowed to stand 5 min in 150 ml of boiling water and wait 5 min cool down.) instant coffee (Nescafe 3 in 1, Istanbul, Turkey - 3 g of a brown powder, 150 ml of boiling water according to the recommendation of the manufacturer and waited for 5 minutes to cool down.), cola (the Coca-Cola Company, Turkey) and red wine (Dikmen, Kavaklıdere, Ankara, Turkey) as 5 different coloring solution was used. In the restorative material, distilled water was used to examine intrinsic color changes and as a control.

All samples were stored in solutions for 30 days and the solutions were changed regularly. Color measurements of all samples were measured 3 times with the measuring device on both the 1st day, 2nd day, 7th day, 21st and 30th day, and the measurements were averaged. Before all measurements the samples were washed under running water for 10 s and lightly dry without pressing the paper towel.

Color Assessment

The spectrophotometer (Lovibond, The Tintometer® Group, Lovibond House, UK) was used for color measurements and the device was calibrated in accordance with the operating instructions before each measurement. Measurements were made on the standard white background, which is fixed on the device itself. The mean L, a, b values were obtained by measuring 3 times from each sample. The ΔE values between the composite samples were calculated using the CIEDE 2000 formula.

Statistical Analysis

The mean values obtained were compared with ANOVA in multiple groups, and Bonferonni test in paired comparisons for cases where the data provided normal distribution. Kruskall Wallis and Mann Whitney-U test were used for nonparametric conditions. The analyzes were interpreted at 95% confidence level. Graphs are plotted with MS Excel 2017. The analyzes were performed in SPSS 23.0 package program.

III. Results

Differences between the samples according to the days and the solutions used in the study were examined and the statistical summary of the results obtained and the differences between the groups are given in Table 1.

When the differences in the table were examined, no statistically significant difference was found between the tinting measurements of water from day 1 to day 30 ($p = 0.205$). In all other solutions, the colorings increased with time. After 30 days, all mean measurements were statistically increased in tea, instant coffee, cola and wine solutions ($p < 0.001$).

When the differences between the day-based solution measurements were examined, it was observed that there were differences in the daily measurements of the solutions ($p < 0.001$).

When the paired comparisons were examined, water and cola were not different from each other ($p = 0.181$); and coffee and tea were found to have higher scores than water and cola ($p = 1,000$), but wine was higher than other solutions ($p < 0.001$).

Table 1: Statistical table showing the coloration of the samples for 30 days

	Day_1		Day_2		Day_7		Day_21		Day_30			
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Test**	**p**
Water	0,70	0,40	0,61	0,36	0,83	0,51	0,72	0,57	0,87	0,60	1,633	0,205
Tea	1,90	0,75	2,41	0,66	2,68	0,70	4,78	1,11	5,72	0,94	82,996	<0,001
Nescafe	2,90	1,06	3,22	1,00	4,52	0,81	5,21	1,04	5,64	0,99	71,799	<0,001
Coke	1,34	0,92	1,57	0,86	1,50	0,81	1,90	0,98	2,12	1,01	11,143	<0,001
Wine	7,85	1,34	9,18	1,93	13,77	2,91	16,85	3,20	18,50	3,41	111,707	<0,001
Test	219,286		226,151		317,901		357,211		396,989			
p	<0,001		<0,001		<0,001		<0,001		<0,001			

Graph 1: Graph showing the results of the coloration of the samples in solution for 30 days according to the solutions

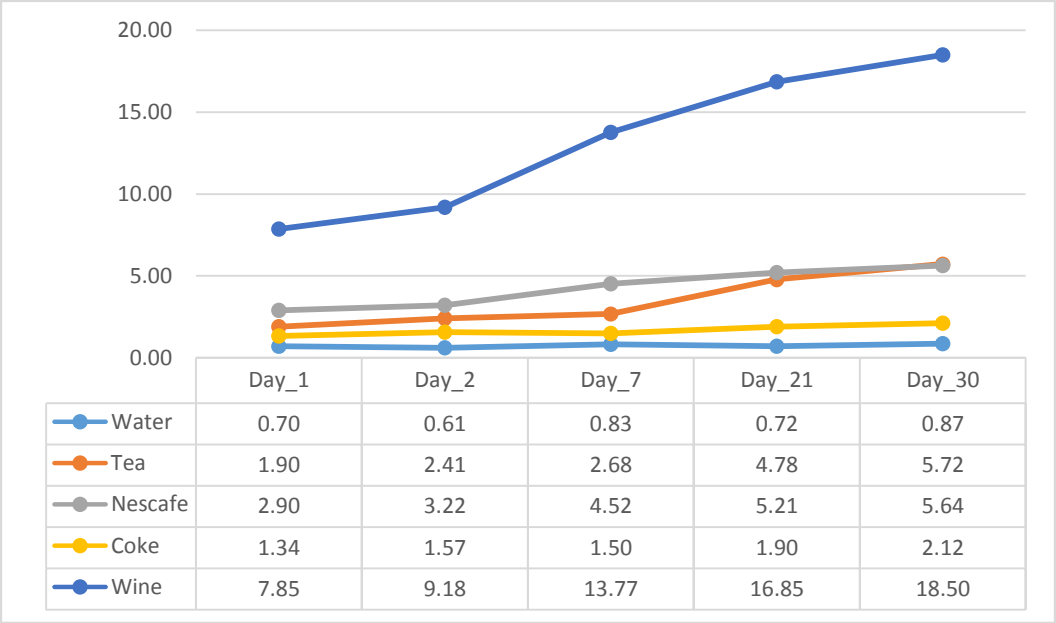


Table 2 and Graph 2 were obtained when the differences between the last day and first day of the groups were analyzed. As can be seen from the results, differences between the last day and first day measurements of water and cola cannot be obtained, while the differences of the differences in all other solutions are different. The most coloring was made of red wine. There was no difference between cola and water in terms of coloring. Tea takes second place and nescafe is 3rd.

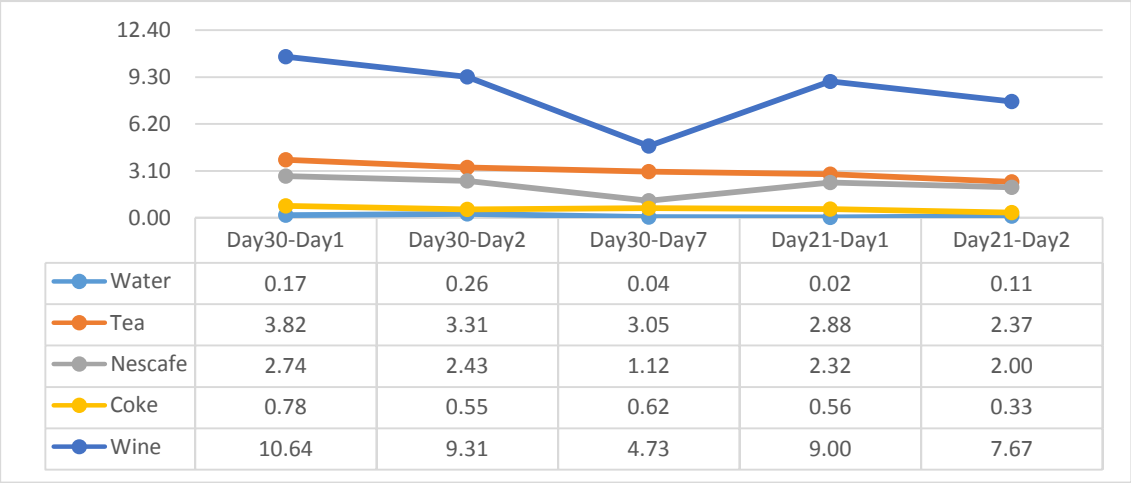
When the mean examination was made according to the differences, it was seen that tea and wine were colored in 30 days (>3.1) and this difference was not obtained statistically in the others. Likewise, 30 days to 2 days, 30 days to 7 days, 21 days to 1 day and 21 days to 7 days between the average measurements of the differences in the first measurement of only 3.1 in the first cut, while the tea and wine passes, all other measurements only coloration has been experienced in wine.

Table 2: Difference table of coloration of samples according to days

Day30-Day1, Day30-Day2, Day30-Day7, Day21-Day1, Day21-Day2 Difference Table										
	Day30-Day1		Day30-Day2		Day30-Day7		Day21-Day1		Day21-Day2	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Water	0,17	0,43	0,26	0,69	0,04	0,71	0,02	0,46	0,11	0,62
Tea	**3,82**	1,13	**3,31**	1,10	3,05	0,91	2,88	1,07	2,37	0,96
Nescafe	2,74	0,75	2,43	0,91	1,12	0,85	2,32	0,86	2,00	0,96
Coke	0,78	0,63	0,55	0,67	0,62	0,50	0,56	0,71	0,33	0,51

Wine	**10,64**	2,36	**9,31**	2,23	**4,73**	2,22	**9,00**	2,28	**7,67**	2,09

Graph2: Graph showing the difference of coloration of samples according to days



	Day30-Day1	Day30-Day2	Day30-Day7	Day21-Day1	Day21-Day2
Water	0.17	0.26	0.04	0.02	0.11
Tea	3.82	3.31	3.05	2.88	2.37
Nescafe	2.74	2.43	1.12	2.32	2.00
Coke	0.78	0.55	0.62	0.56	0.33
Wine	10.64	9.31	4.73	9.00	7.67

IV. Discussion

To achieve aesthetics, restorative materials in tooth-color should be able to maintain internal color stability and be resistant to surface coloration [15].

Dental restorative materials are exposed to many coloring agents in foods and beverages taken with diet in the mouth. Studies have shown that both glass ionomer and resin composites are not resistant to coloration against various beverages [15,26]. Many studies have been used for tea, coffee and cola discoloration [27,28].

In the literature, there are numerous studies examining the effects of resin materials on coloration after being kept in drinks such as tea, coffee, etc. [29,30]. In the studies, the coloring effect of many factors such as tea, coffee, cola, wine, soy sauce, grape juice, chlorhexidine, vinegar, ayran, orange juice and yogurt on composite resins have been investigated [31,32]. In our study, tea, coffee, cola and red wine were used in parallel with these studies.

Water absorption and solubility of composite resins are affected by the time of testing. Tea, coffee, wine and cola studies have variable application time. Villalta et al. (2006), the samples for 40 days daily for 3 hours in the color solution, 21 hours in distilled water [33]. Bagheri et al. (2005), for 1 week after a week in distilled water in colorant solutions kept waiting [15]. Dietschi continued the staining experiment for 3 weeks [21].

Çelik et al. (2016) samples were kept in coffee, red wine, cola and distilled water for 3 hours a day and on the 1st, 7th, 15th and 30th days, they measured the color with the help of spectrophotometers [34].

In another study, the samples were kept in tea, coffee, cola, red wine and distilled water for 3 hours after the initial color measurements and color changes were measured by spectrophotometer on the 1st, 7th, 15th and 30th days [35].

In our study, the samples were incubated for 30 days in a 24-hour colorant solution in a total of 720 hours of colorant solution. This period corresponds to an average of 2 days to about 59 years of staining time, based on the contact time of the solutions with the composite resins. Daily 2-minute coloration time previously Gürdal et al. (2002) used in the study of the effect of mouthwashes on the coloration of aesthetic restorative materials [36].

In our study, samples prepared from 1 composite resin were kept in 5 different solutions such as distilled water, tea, instant coffee, cola and red wine. After the initial color measurements were taken from the samples, solutions were kept in the solutions for 30 days and color measurements were made on the 1st, 2nd, 7th, 21st, and 30th days.

Paravina et al. (2005) determined the colorless values that were considered to be clinically unsuccessful, for CIE L * a * b system ΔEab values greater than 3.7 and for CIEDE 2000 system ΔE were values greater than 3.1 [37]. . In our study, because of the use of CIEDE 2000 system, acceptability limit was accepted as ΔE values less than 3.1.

Ertas et al. (2006) examined 5 different composite resins (Filtek P60, Filtek Z250, Filtek Yüce XT, Grandio, Quarter LC) with a colorimeter with colors including water, cola, tea, coffee and country. All colors and colors were determined in water and the most color changes were determined in red wine. The color changes in tea and coffee were different in color, but ΔEab * was higher than 3.3 for all compounds for color changes. They have also found differences in different colors to find differences [38].

Türkün and Leblebicioğlu (2003) compared the effects of color change on coffee, tea and cola in three direct composite resins (Surefil, Filtek P60, Clearfil Photo Posterior). According to this study, the most color change of the coffee, the lowest color change is made to the cola. It was observed that the colors of the samples kept in coffee were darkened and red and yellow were more dominant [39].

Barutcigil and Yildiz (2012) in a study to evaluate the internal and external color changes of dimethacrylate and silo based composites, 5 different composite materials were stored in red wine, coffee, cola, tea and distilled water. Color measurements were made. While most color change is seen in red wine in all resins, it is reported that all restorative materials are sensitive to the coloration of these commonly used beverages, especially for wine and coffee [40].

Hosoya and Goto (1992) composite resin in distilled water in terms of color change evaluated. When color measurements were made on the 1st and 3rd, 6th, 12th months, more color changes were observed at the end of the 12th month than at the end of the 6th month [41].

In another in vitro study, composite resins were kept in tea and coffee and compared on the 1st, 7th and 30th days in terms of color change. On the 30th day of the study, it was found that the color change values increased according to the 7th day [42].

In our study, in parallel with these studies, it was determined that the coloration of all samples increased as the waiting times increased.

In a study by Ertaş et al (2006), the solutions which caused color change in the materials tested were listed according to the degree of color change: water <cola <tea <coffee <red wine [38].

V. Conclusion

As a result of our study, it was seen that the coloring of composite resin restorations increased with the increase in waiting times in solutions. Red wine solution which causes the most coloration among the solutions used, while there is no significant difference in the samples kept in distilled water. The coloration order of the solutions was determined as distilled water = cola <nescafe <tea <red wine.

References

[1]. Dayangaç, B. (2011). Kompozit Restorasyonlar: Quintessence Yayıncılık.
[2]. Mccabe JF, Walls AWG. Applied Dental Materials. Eigth edition, s. 63-68; 96-114 Blackwell Science Ltd. London UK, 1998.
[3]. Buonocore, M. G. 1955. "A Simple Method of Increasing the Adhesion of Acrylic Filling Materials to Enamel Surfaces." *Journal of Dental Research* 34 (6): 849–53.
[4]. Bowen, R. L. 1965. "Adhesive Bonding of Various Materials to Hard Tooth Tissues. III. Bonding to Dentin Improved by Pretreatment and the Use of Surface-Active Comonomer." *Journal of Dental Research* 44 (5): 903–5.
[5]. Celik, Esra Uzer, Akin Aladağ, L. Şebnem Türkün, and Gökhan Yilmaz. 2011. "Color Changes of Dental Resin Composites before and after Polymerization and Storage in Water." *Journal of Esthetic and Restorative Dentistry: Official Publication of the American Academy of Esthetic Dentistry ... [et Al.]* 23 (3): 179–88.
[6]. Vichi, A., A. Fraioli, C. Davidson, and M. Ferrari. 2007. "Influence of Thickness on Color in Multi-Layering Technique." *Dental Materials: Official Publication of the Academy of Dental Materials* 23 (12): 1584–89.
[7]. Asmussen, E. 1982. "Factors Affecting the Quantity of Remaining Double Bonds in Restorative Resin Polymers." *Scandinavian Journal of Dental Research* 90 (6): 490–96.
[8]. Pearson, G. J., and C. M. Longman. 1989. "Water Sorption and Solubility of Resin-Based Materials Following Inadequate Polymerization by a Visible-Light Curing System." *Journal of Oral Rehabilitation* 16 (1): 57–61.
[9]. Fontes ST, Fernández MR, Moura CM, Meireles SS. Color stability of a nanofill composite: effect of different immersion media. J Appl Oral Sci 2009; 17: 388-391.
[10]. Lazetti G, Burgess JO, Gardiner D, Ripps A. Color stability of fluoride containing restorative materials. Oper Dent 25(6): 520-525, 2000.
[11]. Asmussen E. Factor affecting the color stability of restorative resins. Acta Odontol Scand 1: 11-18, 1983.
[12]. Ferracane JL, Moser JB, Greener EH. Ultraviolet light induced yellowing of dental restorative resine. J Prosthet Dent 54: 483-487, 1985
[13]. Gurdal P, Guniz AB, Hakan SB. The effects of mouthrinses on microhardness and color stability of aesthetic materials. J Oral Rehabil 29: 895-901, 2002.
[14]. Hosoya Y. Five year color changes of light-cured resin composites: influence of light-curing times. Dent Mater 15: 268-74, 1999
[15]. Bagheri R, Burrow MF, Tyas M. Influence of foodsimulating solutions and surface finish susceptibility to staining of aesthetic restorative materials. J Dent 33: 389-398, 2005.
[16]. Ergücü Z, Türkün LS, Aladag A. Color stability of nano-composites polished with one-step system. Oper Dent. 2008;33:413-420
[17]. Satou N, Khan AM, Matsumae I, Satou J, Shintani H. In vitro color change of composite-based resins. Dent Mater 5(6): 384-7, 1989
[18]. Nasim I, Neelakantan P, Sujeer R, Subbarao CV. Color stability of microfilled, microhybrid and nanocomposite resins--an in vitro study. J Dent. 2010;38:137-142.
[19]. Mitra, Sumita B., Dong Wu, and Brian N. Holmes. 2003. "An Application of Nanotechnology in Advanced Dental Materials." *Journal of the American Dental Association* 134 (10): 1382–90.
[20]. Craig, Robert George, and John M. Powers. 2002. *Restorative Dental Materials*. Mosby Incorporated.
[21]. Dietchi D, Campanile G Holz J, Meyer JM. Comparison of the color stability of ten new-generation composites: an in vitro study. Dent Mater 10: 353-62, 1994.
[22]. Reis FA, Giannini M, Lovadino RJ, Ambrosano MG. Effects of various finishing systems on the surface roughness and staining susceptibility of packable composite resins. Dent Mater 19: 12-18, 2003.
[23]. Xu, H. H. K., J. B. Quinn, and A. A. Giuseppetti. 2004. "Wear and Mechanical Properties of Nano-Silica-Fused Whisker

Composites." *Journal of Dental Research* 83 (12): 930–35.
[24]. Gurdal P, Guniz AB, Hakan SB. The effects of mouthrinses on microhardness and color stability of aesthetic materials. J Oral Rehabil 29: 895-901, 2002.
[25]. Shintani H, Satou J, Satau N, Hayashihara H, Inoue T; Effects of various finishing methods on staining and accumulation of streptococcus mutans hs-6 on composite resins. Dent Mater 1: 225-7, 1985
[26]. Abu-Bakr N, Han L, Okamoto A, Iwaku M. Color stability of compomer after immersion in various media. J Esthet Dent. 2000;5:258-63
[27]. Guler AU, Yilmaz F, Kulunk T, Guler E, Kurt S. Effects of different drinks on stainability of resin composite provisional restorative materials. J Prosthet Dent. 2005;2:118-24.
[28]. Topcu FT, Sahinkesen G, Yamanel K, Erdemir U, Oktay EA, Ersahan S. Influence of different drinks on the colour stability of dental resin composites. Eur J Dent. 2009;1:50-6
[29]. Burrow MF, Makinson OF. Color change in lightcured resins exposed to daylight. Quintessence Int. 1991;6:447-52.
[30]. YAZICI, A.R., CELIK C., DAYANGAÇ, B., OZGÜNALTAY, G. (2007). The effect of curing units and staining solutions on the color stability of resin composites. Oper. Dent., 32(6): 616-622.
[31]. Turkun, M., Turkun, L.S. (2004) Effect of nonvital bleaching with 10% carbamide peroxide on sealing ability of resin composite restorations. *IntEndod J*, 37 (1), 52-60.
[32]. Sarı ME, Koyutürk AE, Çankaya S. Çocukların sıklıkla tükettiği yiyecek ve içeceklerin farklı dolgu materyallerinin rengine etkisi. Turkiye Klinikleri J Dental Sci 2010;117(2):140-146.
[33]. Villalta P, Lu H, Okte Z, Garcia-Godoy F, Powers JM. Effects of staining and bleaching on color change of dental composite resins. J Prosthet Dent 95:137-42, 2006.
[34]. Celik, N. , Sağsöz, Ö. ,Gündoğdu, M. (2016) Evaluation of The Different Effects On Color Changes And Surface Roughness Of Posterior Composites. Atatürk Üniv. Diş Hek. Fak. Derg. Cilt:27, Sayı 1, Yıl:2017, Sayfa 27-33.
[35]. İşcan Yapar M. ve Gül P. (2014). Farklı İçeceklerde Bekletilen Siloran Ve Dimetakrilat Esaslı Kompozitlerin Renk Stabilitelerinin Karşılaştırılması. Acta Odontol Turc 2015;32(2):51-6
[36]. Gurdal P, Guniz AB, Hakan SB. The effects of mouthrinses on microhardness and color stability of aesthetic materials. J Oral Rehabil 29: 895-901, 2002.
[37]. Paravina RD, Kimura M, Powers JM. Evaluation of polymerization-dependent changes in color and translucency of resin composites using two formulae. Odontology. 2005;93:46–51
[38]. Ertaş E, Güler AU, Yücel AC, Köprülü H, Güler E. Color stability of resin composites after immersion in different drinks. Dent Mater J. 2006;2:371-6.
[39]. Türkün LS, Leblebicioglu EA. İki yeni polisaj sistemin posterior rezin kompozitlerin renk stabilitesine etkisi. Hacettepe Üni Dishek Fak Derg. 2003;2:52-60.
[40]. Barutcigil, Çağatay, ve Mehmet Yıldız. 2012. "Intrinsic and Extrinsic Discoloration of Dimethacrylate and Silorane Based Composites." *Journal of Dentistry* 40: e57–63.
[41]. Hosoya Y. Five year color changes of light-cured resin composites: influence of light-curing times. Dent Mater 15: 268-74, 1999
[42]. Yannikakis SA, Zissis AJ, Polyzois GL, Caroni C. Color stability of provisional resin restorative materials. J Prosthet Dent. 1998;5:533-9.

Hakan Yasin GÖNDER. "Comparıson Of Coloratıon Of Composıte Resın Restoratıons As A Result Of Waıtıng For Dıfferent Solutıons. " IOSR Journal of Dental and Medical Sciences (IOSR-JDMS), vol. 17, no. 11, 2018, pp 63-69.