

Review Article

The effect of coffee on color stability and surface characteristics of a nanofilled composite resin – A Systematic Review

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ABSTRACT:

Aims and objectives: The aim of this study is to assess the effect of coffee on color stability and surface characteristics of a nanofilled composite resin. **Materials and methods:** A literature review was performed using Medline, Pubmed, Wiley, Science direct, Cochrane Central Register of Controlled Trails (CENTRAL), Scopus, and Grey literature using MeSH terms – “color stability and surface characteristics of a nanofilled composite resin”. **Result:** Among four trails, three found statistically significant response favoring the effect of coffee on color stability and surface characteristics than other such immersion medium. **Conclusion:** In the available literature, the effect of coffee had an influence over the color stability and surface characteristics in a nanofilled composite resin.

Received: 18 January, 2023

Accepted: 22 February, 2023

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This article may be cited as: Dhanushree, V VB, Dhamodhar D, S S, D P, M R, R S. The effect of coffee on color stability and surface characteristics of a nanofilled composite resin – a systematic review. J Adv Med Dent Scie Res 2023;11(3):23-27.

INTRODUCTION

In the modern dentistry the use of resin composite is progressing gradually due to its advantageous qualities such as physical, mechanical and aesthetic importance.¹ The color of composite resin in the esthetic part have played an important role, but the common problem faced is that the material changes its physical properties with long term use.² On the other hand, composites having macro fill materials that are strong but difficult for polishing and keep hold on the surface smoothness. Hence, to compromise the issue micro fill composites were formulated. Further innovation to nanofill composites was done that contains only nanoscale particles.³ For the alteration in the color the factors influenced maybe intrinsic or extrinsic. Intrinsic factors includes such as the camphorquinone in visible light curing that causes yellowish discoloration. Further, some chemical changes in the photoinitiator system- oxidation of ammine accelerators may cause brown or yellow discoloration in the influence of heat or light.⁴ Other

than this there are additional factors responsible for the color stability such as the depth of polymerization, resin matrix, coloring agents, and dimension of filler particles. Extrinsic factors are influenced by physiochemical characteristics- penetration or adhesion of stains from an external source such as tea, coffee, beverages, nicotine etc. in the surface of resin composite.³ Alteration in the color of the surface subsurface of the resin restoration may occur within the mouth as a result of superficial degeneration or a moderate penetration and adsorption of staining agents at the superficial layer of composite resin.⁵ Beverage erosive activity disrupts the composite restoration, leaving a rough surface that alters the material's optical qualities and facilitates the formation of bacterial plaque and degradation of restoration's surface. Erosion reduces the hardness and wear resistance of a material. Furthermore, surface roughness can irritate the gingiva and raise the risk of subsequent caries. As a result, the surface features of a resin composite contributes to the restoration's clinical lifespan.⁶ This study was conducted to check the color stability and surface

roughness of resin restoration when immersed in coffee as a medium.¹ The objective of the study is to evaluate the effect of coffee on colour stability and surface characteristics of a nano-filled composite resin.

MATERIALS AND METHODS

INCLUSION CRITERIA

- Original article
- Full text article
- Articles on effect of coffee on color stability and surface characteristics of composite resin.

EXCLUSION CRITERIA

- Review articles
- Articles without open access

- Studies written in other language were disqualified.
- Studies done other than composite resin

SEARCH STRATEGY

Published literatures on recent advancements in assessing the effect of coffee on colour stability and surface characteristics of a nanofilled composite resin which includes original articles and research papers in databases such as PubMed Central, Science Direct, and Cochrane Central Register of Controlled Trails (CENTRAL). The MeSH phrase “colour stability and surface characteristics of nanofilled composite” were used to conduct literature search to find pertinent information.

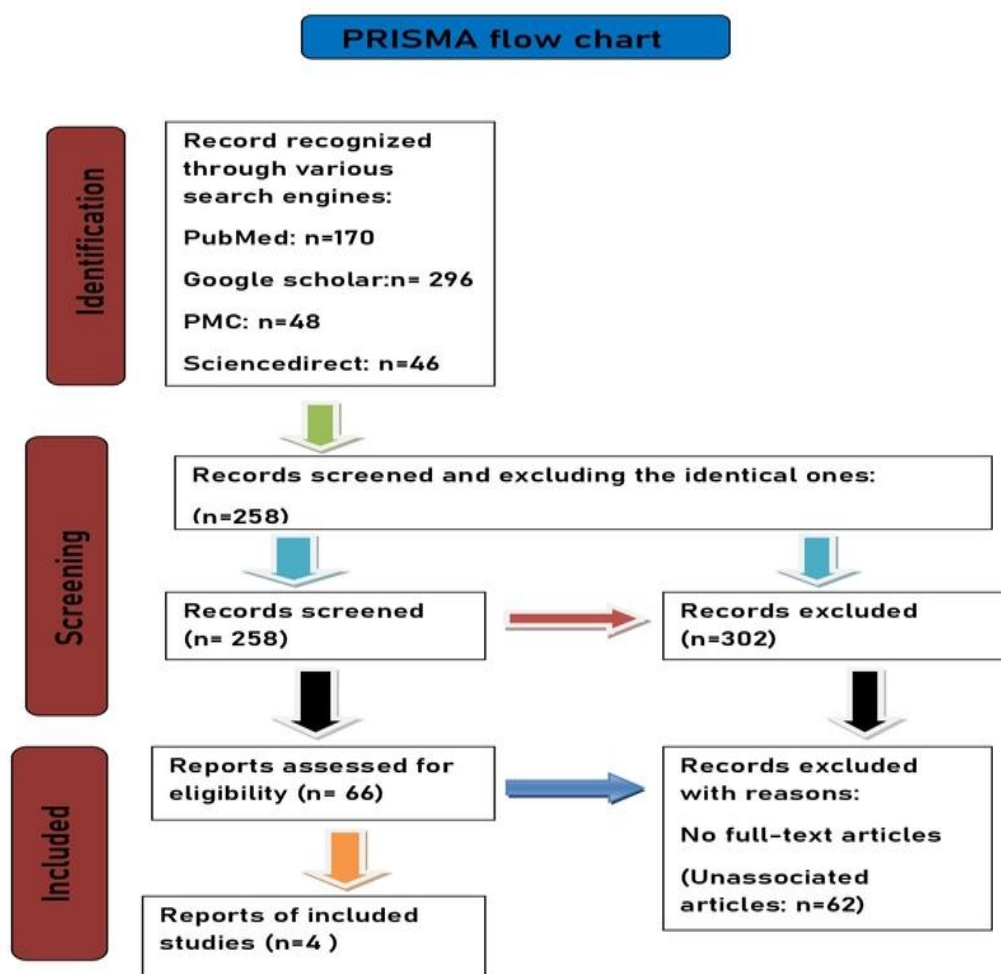


Table 1: showing the number of data included and studies taken for qualitative analysis

Author	Year	Sample size	Sample characteristics
Patricia Aleixo dos Santos Domingos , Patrícia Petromilli Nordi Sasso Garcia , Ana Luisa Botta Martins de Oliveira , Regina Guenka Palma-Dibb	2011	180 total specimens	Group 1: Artificial saliva Group 2: Coke Group 3: tea Group 4: coffee
Duygu Tuncer, Emel	2019	5 groups of	Group 1: Artificial saliva at 37° C

Karaman, Esra Firat ³		10 specimens each	Group 2: Cola at 10°C Group 3: Cola at 37°C Group 4: Coffee at 70°C Group 5: Coffee at 37°C
Mohammad Reza Malekipour , Ala Sharafi , Shantia Kazemi , Saber Khazaei , Farzaneh Shirani	June 2012	5 groups of 13 specimens	Group 1: distilled water Group 2: cola Group 3: behnoosh lemonade Group 4: Ahmad tea Group 5: Farmand turkey coffee
Silvia Terra Fontes, María Raquel Fernández, Claudia Modena de Moura, Sônia Saeger Meireles	2009	12 specimens	Group 1: coffee Group 2: yerba mate Group 3: grape juice Group 4: distilled water

Table 2: outcome data as reported in the included studies

Author	Year	Sample size	intervention
Patricia Aleixo dos Santos domingos , Patrícia Petromilli Nordi Sasso Garcia , ana Luisa Botta Martins de Oliveira, Regina Guenka Palma-dibb	2010	180 total specimens	There was no significant difference between light sources on inducing changes of color stability of the composite resin; Coffee was the tested immersion medium that had the highest alteration on color stability of the composite resin, followed by tea; The immersion time gradually altered the color stability of the composite resin up to 30 days of immersion, with the highest activity observed in the 30 to 60 day period
Duygu Tuncer, Emel Karaman, Esra Firat	2019	5 groups of 10 specimens each	Temperature rise in beverages can cause alterations in certain properties of composites, such as increased color change and decreased microhardness, although it did not affect the roughness of the composite resin material tested. <ul style="list-style-type: none"> • Cola was had most reduced surface hardness of the composite resin tested. • Coffee, especially at 70°C, caused more discoloration of the composite resin surface.
Mohammad Reza Malekipour , Ala Sharafi , Shantia Kazemi,Saber Khazaei , Farzaneh Shirani	June 2012	5 groups of 13 specimens	The highest color change was caused by tea, at different time periods, and the minimum color change was caused by water, after seven and fourteen days, and coffee after one day of submersion.
Silvia Terra Fontes María Raquel Fernández, Claudia Modena de Moura, Sônia Saeger Meireles	2009	12 specimens	Staining was not preferabaly done by coffee but grape juice caused perceptible color changes on the composite resin

Table 3: bias assessment of included studies

Author name year	Random sequence generation	Allocation concealment	Blinding of the outcome	Incomplete outcome data	Blinding of participant and personnel	Selective reporting	Judgemental basis
Domingos Pas, Garcia Ppns, Oliveira Albm, Palma-Dibb Rg 2010	+	+	-	+	-	?	?

Tuncer, et al. 2019	+	+	-	+	-	?	?
Malekipour, et al 2012	+	?	-	+	-	?	?
Fontes S T, Fernández M R, Moura C M De, Meireles S S 2009	+	?	-	+	-	?	+

+ = low risk of bias; - = high risk of bias; ? = unclear risk of bias

DISCUSSION

Tooth colored restorative material such as composite are continuously exposed to many external and internal factors in the oral environment². Therefore, it is important to analyze this multifaceted phenomenon to determine their susceptibility to color change and surface roughness¹. Color change of composite resins with time has an impact over the esthetics procedure and hence consider to be disadvantageous. In this study, the immersion media is considered to be the influential factor of optical alterations of the resin³. Coffee has been selected as the immersion media in this study to examine the change in color stability and surface roughness.

This in vitro study can be examined either by visual assessment with shade guides or with the use of digital spectrophotometer⁴. Usually coffee was considered to show extremely perceptible change in many studies¹. Patricia Aleixo dos Santos domingos, Patrícia Petromilli Nordi Sasso Garcia, Ana Luisa Botta Martins de Oliveira, Regina Guenka Palma-Dibb reported a significant difference in color change of composite resin in respect to coffee as immersion medium. The immersion time influenced over a period of 30 days with greatest activity observed in the time period of 30 to 60 days¹. Tuncer, *et al* significantly reported that coffee at 70° C showed highest activity of discoloration of the surface of composite resin although it did not affect the surface roughness of the resin. The higher was the temperature the more the discoloration caused by coffee was reported². Malekipour, *et al*. significantly reported that coffee showed the least and most discoloration on the first and fourteenth day respectively. Time was considered to be the dominating factor of the progressive color change of the effect of coffee on composite resin³. Fontes s t, Fernández m r, Moura c m de, Meireles s s significantly reported that coffee did not show perceptible color change⁴.

Thus it is relevant that coffee is considered to have favorable effect on color stability and surface characteristics of a nanofilled composite resin. Coffee

with higher degree of pH has greater potential to influence the physical property of the resin. The oral environment can also be an influential factor in the transformation. This acquired results are useful in the field of esthetic dentistry for the right selection of material and in order to alert the patients for the consumption of beverages. Diagnostic criteria is made better for treatment decisions using the application machine learning and deep learning.⁸ Some health indicators such as misery index are used for improving nation's health score in order for betterment.⁹

CONCLUSION

Coffee is the commonly preferred beverage among Indian population. **Tannis** in coffee is considered to be the responsible factor in alteration of the color in coffee that is widely accepted. Direct adhesive composite restoration being a commonly preferred technique to restore tooth defects, it manipulates the characteristics and causes stains due to prolonged exposure to coffee. As tooth colored restorative material is mainly preferred for esthetics reasons its longevity should be taken into consideration. For coffee lovers, we dentist have to be mindful if we are going for anterior composite restoration and a prior warning has to be given in that conditions.

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