Impact of Fermented Milk Soaking on Microhybrid Composite Resin Surface Roughness

Irsan Ibrahim[*,**], *Tuti Alawiyah*[*], *Herlin Amelia*[*], *Drajat Handika Pakci*[***]

[*]*Faculty of Dentistry, Department of Dental Material, Science, and Technology, Prof. Moestopo University, Indonesia*
***Dentist, Resti Mulya Mother and Child Hospital, Jakarta, Indonesia.*
[***]*Faculty of Dentistry, Bachelor of Dentistry Students, Prof. Moestopo University, Indonesia*.

Correspondence: irsan_henshin@yahoo.com; irsanibrahimmsi@dsn.moestopo.ac.id

Received 4 September 2024; 1st revision 7 February 2026;2nd revision 20 April 2026; Accepted 21 April 2026; Published online 29 April 2026

Keywords : *Fermented Milk, Microhybrid Composite Resin, Surface roughness*

ABSTRACT

Background: *One type of restorative substance is composite resin, which also comes in microhybrid form. Surface roughness is one of the clinical characteristics that may serve as a predictor of the longevity of restorative materials. The habit of drinking low-pH beverages is one of the things that influences surface roughness. One of the most consumed beverages in society is a fermented milk beverage. Fermented milk is usually safe for consumption by those with sensitivity to dairy products since the bacteria in it can break down lactose into lactic acid. Lactic acid, which has a pH of 4.2–4.8, is found in fermented milk. The purpose of this research is to ascertain how soaking fermented milk affects the microhybrid composite resin's roughness.*
Method: *This study uses a pre-test post-test design methodology and is conducted in a laboratory setting. There are 27 samples of microhybrid composite resins that are conducted with fermented milk. Prior to and following immersion, the surface roughness of the microhybrid composite resin was measured using a surface roughness tester as part of this study.*
Result: *On the first through the seventh day of immersion, there was a noticeable rise in the surface roughness of the Microhybrid composite resin submerged in fermented milk.* ***Conclusion:*** *After being immersed in a solution of fermented milk for one, four, and seven days, the microhybrid composite resin is affected by its roughness.*

doi: http://dx.doi.org/10.30659/odj.13.1.51-60
2460-4119 / 2354-5992 ©2026 National Research and Innovation Agency

Odonto : Dental Journal accredited as **Sinta 3 Journal** (https://sinta.kemdikbud.go.id/journals/profile/3200)
How to Cite: Ibrahim *et all*. Impact of Fermented Milk Soaking on Microhybrid Composite Resin Surface Roughness. Odonto: Dental Journal, v.13, n.1, p.51-60, April 2026.

INTRODUCTION

Composite resin, particularly in microhybrid form, is widely preferred for anterior and posterior tooth restorations due to its excellent aesthetic properties. The material consists of three key components: a binding agent (or coupling agent), an inorganic filler, and a matrix. The inorganic filler is a critical factor in determining the mechanical properties of the composite resin, and these resins are classified by the size of the filler particles into categories such as hybrid, nanofiller, microfiller, and macrofiller. Microhybrid composite resins, which combine microfiller and macrofiller, are designed to offer durability and aesthetic appeal.[1]

The surface roughness of composite resin can be affected by various factors, one of which is exposure to acidic fluids. Typically, the surface roughness of composite resin is around 0.09 μm, with values under 0.2 μm considered clinically acceptable. However, acidic beverages, including fermented milk, can significantly increase the roughness of composite resin surfaces. This roughness is a key factor in the material's durability and performance in clinical settings.[2,3]

Fermented milk, a popular dairy product made through the fermentation of milk by lactic acid bacteria such as *Lactobacillus acidophilus* and *Lactobacillus casei*, is widely consumed and has a pH ranging from 4.2 to 4.8. The lactic acid produced during fermentation is responsible for the product's acidity, which can be tolerated by people sensitive to lactose. This characteristic makes fermented milk a suitable subject for studying its impact on composite resins.[4]

Previous studies have demonstrated that acidic solutions, such as lime juice and beverages like Coca-Cola, can increase the surface roughness of composite resins. For example, research has shown that after immersing composite resins in acidic solutions for extended periods, the roughness of materials such as microhybrid composites increased significantly. Notably, Albarran (2023) indicated that the surface roughness of flowable composite resins was affected by beverages like fermented milk, with the duration of immersion being a more significant factor than the type of beverage.[5]

Given the comparable acidic pH of fermented milk, it was hypothesized that its immersion would lead to increased surface roughness in microhybrid composite resins. This aligns with earlier findings showing that prolonged exposure to acidic beverages results in surface degradation and increased roughness.[6,7] Several previous studies have investigated the effect of acidic beverages, such as carbonated drinks, coffee, and fruit juices, on the surface roughness of composite resins. However, most of these studies focused on nanofiller or nanohybrid composite resins and different acidic solutions. Limited studies specifically evaluated the effect of fermented milk beverages, which contain lactic acid produced during fermentation, on the surface roughness of microhybrid composite resin. In addition, previous studies used different immersion durations to simulate exposure to acidic beverages. Therefore, this study selected immersion periods of 1, 4, and 7 days to represent short-term and prolonged exposure, as previously applied in studies evaluating changes in composite resin surface properties after acidic immersion.

The aim of this study was to examine the impact of fermented milk on the surface roughness of microhybrid composite resin, contributing to the understanding of how commonly consumed acidic drinks affect restorative materials in dentistry.

RESEARCH METHODS

The study was conducted in an experimental laboratory environment using Te-Econom plus, ivoclar vivadent, Switzerland's microhybrid composite resin material in shade A3. A rectangular acrylic master mould measuring 5 mm by 5 mm by 2 mm was created in order to prepare microhybrid composite resin specimens. A celluloid strip measuring 1 cm by 1 cm was used to line the bottom surface of the mould. Using a plastic filling tool, the core of the mould was filled with microhybrid composite resin, which was then crushed and condensed until the mould was fully filled. The surface was then covered with another celluloid strip. After 40 seconds of light curing, the samples were kept for a full day. The samples were taken out of the mould after hardening, and any extra material was carefully cut away. Three experimental groups, each with nine specimens, were created from a total of 27 specimens.

The fermented milk solution was prepared by providing ten bottles of commercially packaged fermented milk, equivalent to approximately 650 mL. The liquid was then transferred into several small containers used for specimen immersion, and the pH of the fermented milk solution was measured prior to immersion.

Before immersion, all specimens were stored in a desiccator for 24 hours and baseline surface roughness measurements were obtained. The microhybrid composite resin specimens were then immersed in the fermented milk solution for 1 day, 4 days, and 7 days (Picture 1.), according to their respective groups. All immersion procedures were conducted at room temperature (approximately 25°C). The specimens were kept fully immersed in the fermented milk solution throughout the designated immersion periods. The immersion solution was not refreshed during the experiment to maintain a constant static exposure condition throughout each immersion period. Each container was sealed for the designated immersion period, and the specimens were allowed to remain in continuous contact with the solution for the specified duration. After immersion, the samples were removed using tweezers, dried, and stored again in a desiccator for 24 hours.

A profilometer (Surface Roughness Tester) was used to test the surface roughness of the microhybrid composite resin after it had been exposed to the fermented milk solution after the specimens had completely dried. Surface roughness was measured using a surface roughness tester (TIME3221, TIME Group Inc., China).

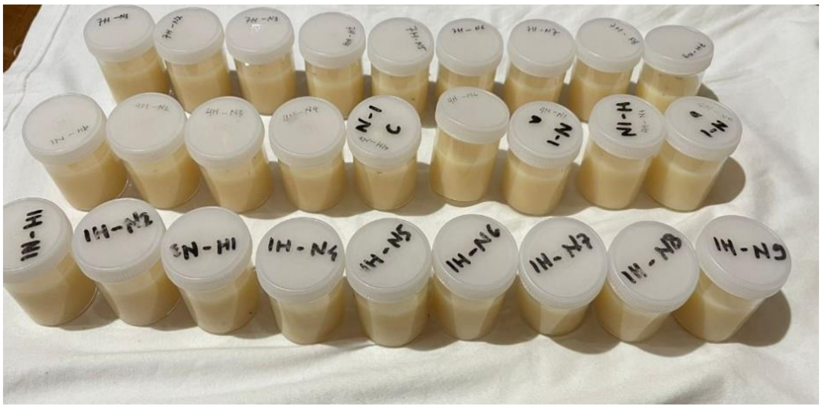

Figure 1. The process of sample immersion for 1 day, 4 days, and 7 days.

Surface roughness measurements were conducted using a surface roughness tester. Prior to measurement, the instrument was calibrated in accordance with the manufacturer’s instructions using a standard calibration block to ensure measurement accuracy. Each specimen was cleaned, dried, and positioned on a stable, flat surface to prevent movement during the measurement process.

The profilometer stylus was positioned perpendicular to the specimen surface, and the measuring direction was aligned parallel to the long axis of the specimen. The cut-off length and evaluation parameters were set according to the standard settings recommended for dental material testing. Surface roughness values (Ra) were obtained by allowing the stylus to traverse the specimen surface at a constant speed and force (Figure 2.).

For each specimen, surface roughness measurements were performed at three different points on the surface, and the mean value of these measurements was calculated to represent the surface roughness of the specimen. All measurements were carried out under identical conditions before and after immersion in the fermented milk solution to ensure data consistency and reliability.

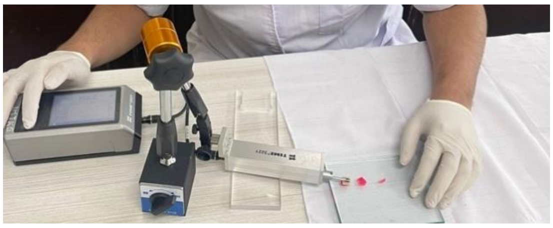

Figure 2. The sample measurement process was performed using a surface roughness tester.

This study's premise was that the surface roughness of microhybrid composite resin was impacted by immersion in fermented milk. By computing the mean and standard deviation of surface roughness values before and after immersion for one, four, and seven days, univariate analysis was used to characterise the data properties. The Shapiro-Wilk test was used to assess the normality of the data. A parametric paired t-test was used in bivariate analysis to compare the mean surface roughness values before and after immersion within each group in order to assess the research hypothesis. Additionally, by examining the variability both within and between groups, One-Way Analysis of Variance (One-Way ANOVA) was used to assess surface roughness differences among the three immersion duration groups. A post hoc test was used to determine differences between certain groups when significant differences were discovered. IBM SPSS Statistics software (IBM Corp., Armonk, NY, USA) was used for all statistical analyses, and $p < 0.05$ was chosen as the level of statistical significance.[8]

RESULTS

Samples passing through the Pre-Test, the initial measurement stage, are placed in a labeled container. Next, milk that has undergone fermentation is used for immersion. The surface roughness number of the microhybrid composite resin filling material is then tested again using a surface roughness tester as the second measurement data (Post-Test) to ascertain the change in surface roughness number before and after immersion. The sample is then dried. Figure 3 shows that the maximum change value was observed during the 7-day immersion period, as determined by analyzing the average roughness level of the microhybrid composite resin after 1, 4, and 7 days.

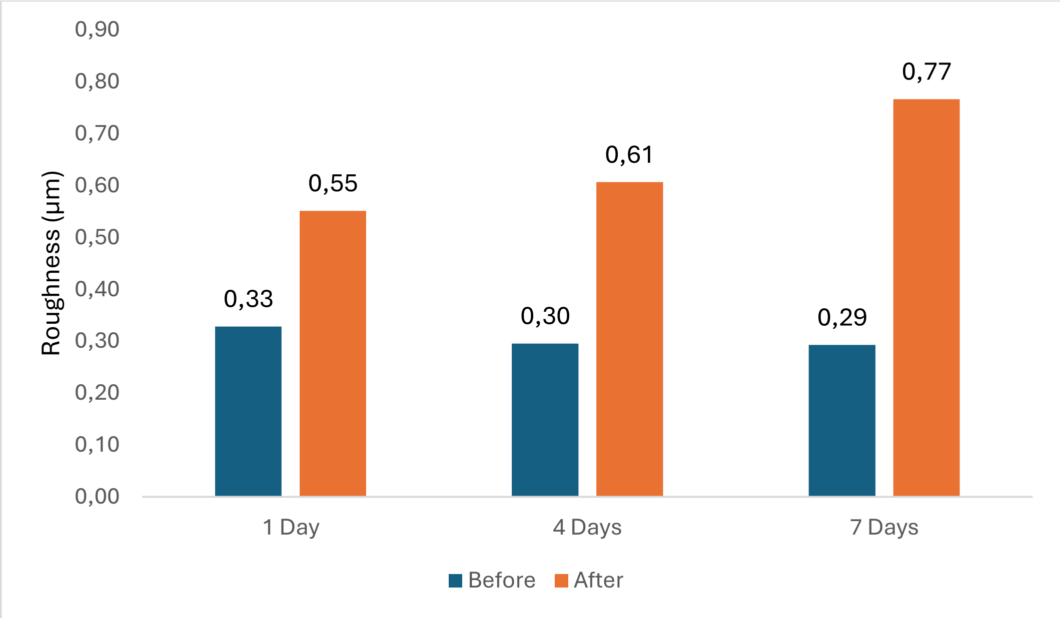

Figure 3. Graph showing the average change in the microhybrid composite resin's roughness value over the course of 1, 4, and 7 days.

Because there are less than 25 samples and the results exhibit normal values ($p>0.05$), the Shapiro-Wilk data distribution is utilized. The normality test computation results indicate that the data is regularly distributed, with a significance level of $p>0.05$. An analysis of variance was conducted using paired t-tests to compare the microhybrid composite resin's roughness before and after immersion.

Table 1. Results of paired t-tests for immersion times of one, four, and seven days.

	N	Corelation	Sig.
Before Soaking for 1 day – after soaking for 1 day	9	0.208	0.000*
Before Soaking for 4 days – after soaking for 4 days	9	0.561	0.000*
Before Soaking for 7 days – after soaking for 7 days	9	0.076	0.000*

*sign $p<0.05$

After soaking for seven days, the microhybrid composite resin's average roughness value was higher than it was before (Figure 1). The average roughness value difference was statistically demonstrated to be different ($p = 0.000$) (Table.1), indicating a significant difference at α 0.05 between the pre- and post-soaking times in fermented milk for 1, 4, and 7 days. One way ANOVA and posthoc tests were also performed to investigate the possibility that the surface roughness of the microhybrid composite resin varied across soaking duration groups.

Table 2. Post hoc analysis of variations in microhybrid composite resin mean roughness values according to immersion time groups.

Immersion Time	1 day	4 days	7 days
1 day	-	0.069	0.000*
4 days	0.069	-	0.005*
7 days	0.000*	0.005*	-

*sign p<0.05

The microhybrid composite resin's mean roughness value was found to be significant between 1 and 7 days, as well as between 4 and 7 days, according to post hoc analysis (Table 2). This was contingent on the immersion time group.

DISCUSSION

Oral conditions and a decrease in pH that solubilises inorganic fillers affect the surface roughness of restorative materials. Acidic conditions in the oral cavity can result in erosive activity, affecting the optical properties of the material, the buildup of bacterial plaque, and the surface deterioration of the repair. Moreover, a coarse surface may exacerbate gingival irritation and increase the likelihood of secondary caries formation. To attain the most polished surface, the upper and lower sections of the 27 microhybrid composite resin samples, categorised into 3 groups, were covered with celluloid strips. The specimens in this investigation possessed a diameter of 5 mm and a thickness of 3 mm. This experiment did not include polishing to prevent surface flaws and voids resulting from the release of fillers, glass particles, and resin matrix during the process. Furthermore, surface irregularities caused by the polished finish may permit the solution to infiltrate the polymer matrix, compromising the integrity of the composite resin.[9]

Unlike Endo's view, polishing is required to reduce granulation and generate a smoother surface since, after curing, the surface of composite resin with bigger and irregular fillers tends to be more prominent.[10] Further roughness can be avoided with polished surfaces. The surface of the filler is more likely to sustain damage on rough surfaces. Therefore, it may harm the filling's surface, particularly at the edges, and result in microleakage or pores that facilitate the entrapment of food and liquids. This state facilitates destruction at the margin and leads to discolouration and secondary caries.[11]

After being submerged in fermented milk beverages for 1, 4, or 7 days, each group in the study washed with water and the roughness of their surfaces was examined. Using a Surface Roughness Tester, the samples were examined for roughness, and the findings were then examined. Vionna and Afrida's research, which demonstrated that the nanohybrid composite resin was soaked for one day, four days, and seven days, was the basis for choosing this time difference.[12,13] The pH of the fermented milk employed in this investigation is 3.77, indicating an acidic nature.

According to Anusavice, the composite's mechanical and chemical components are what lead to composite resin breakdown. Acidic pH is the source of chemical elements that degrade composite resin and impact its surface roughness.[14] The results of Diansari's research indicate that the resin surface roughness increased when the composite resin was immersed for four days in a pH 5.04 solution containing different acids.[12] This is consistent with study by Annabelle, which shows that tooth erosion increases with the acidity of the food or drink that comes into contact with the composite resin's surface. Roughness on the surface of composite resin is a known consequence of erosion, which also demineralizes hard tooth tissue and damages dental restorations. Based on the results of the paired t-test (Table 1), this study showed that the amount of roughness on the composite resin's surface changed significantly ($p<0.05$) after the resin was soaked in fermented milk for one, four, and seven days. This suggests that the pH value's acidity may have an impact on the roughness factor.

Lactic acid bacteria's fermentation process, which can turn fermented milk acidic and produce lactic acid compounds with a chemical molecular structure that contains excess H^+ ions, is what causes the roughness factor in microhybrid composite resin soaked in fermented milk. Because of the crosslink bond that forms between the H^+ ions and the excess H^+ ions, the double bond of the matrix polymer is broken, leading to the instability of the chemical bonds in the double chain of the composite resin matrix polymer. Because of the degradation process, the matrix material will erode and leave irregularities in the filler structure, which will cause the composite resin's surface to become rough.[7]

Sakaguchi claimed that matrix deterioration as a result of acid generation is linked to an increase in surface roughness on composite resin. According to Vionna's research, the roughness of composite resin that was soaked in cola for six days revealed alterations to the surface microstructure in the form of pores. The breakdown process in cola exhibits a similar behavior to that of aquades, but with greater outcomes because of the acidic pH.[12] The study's findings indicate that the microstructure of the composite resin changes as a result of exposure to acid in fermented milk, which leads to deterioration.

Examining the variations in roughness after a single day of immersion, the average roughness before and after was 0.32844 μm and 0.55144 μm, respectively. The composite resin's level of roughness increased during the four days of immersion, averaging 0.29555 μm before and 0.60644 μm after exposure. During the 7-day immersion, the composite resin's level of roughness also increased, with an average before immersion of 0.29277 μm and an average after immersion of 0.76655 μm. This indicates that the level of roughness increased from 1 day to 7 days, increasing as the immersion time increased. Tiffany's research, which examined the roughness of composite resin after soaking it in black tea, is consistent with this. She found that the longer the resin is soaked, the more acid is absorbed. This acid can then weaken the matrix of the composite resin and cause ion structures like silicon and aluminum to be lost from the glass phase, which results in surface roughness. Selvy's research findings, which indicate that the length of time the composite resin is soaked influences the composite resin's nanofiller surface roughness, corroborate this study.[7]

Comparing the 7-day group's average roughness value to other immersion groups, the study's findings indicated that this group's average roughness value was higher. This, however, differs from a study by Afrida that found that low roughness was produced by nanohybrid composite resin soaked in black tea for seven days. The study evaluated the surface roughness variations between nano composite resin soaked in coffee and black tea. Given that black tea has a higher pH than coffee and contains more polyphenols without polar structures, its low average surface roughness value can be explained. However, the results of this study are consistent with a study by Viodetta et al. (2021), which found that higher roughness results were obtained when soaked for seven days. This leads to less strong physical chemical bonds and less hydrogen ions H^+ being released, which reduces the amount of matrix material that is eroded due to degradation and produces a lower surface roughness of the composite resin produced.[7,13,15–19]

This study establishes that the microstructure of the composite resin deteriorates due to exposure to acid in fermented milk, which has a pH of 3.77. This leads to alterations in the microstructure of the composite resin, subsequently forming pores on its surface. The use of composite fillers will augment the volume of voids within the polymer matrix, so promoting the passage of liquids from the outside to the interior of the composite resin, thereby enhancing its roughness. The composite resin, comprising diluent monomer and bis-GMA, absorbs water, resulting in heightened surface roughness. The absorbed water will induce hydrolysis of the filler's chemical connections with the matrix, resulting in the liberation of the filler and the dissolution of the resin matrix.[12,20] The surface roughness of the composite resin can be augmented by filler protrusions formed when the resin matrix dissolves in the acidic solution. The acidic pH in this study results in deterioration due to the presence of hydrogen ions that bond with the resin matrix monomers (bis-GMA, bis-EMA, TEGDMA, and UDMA). The polymer will detach from the resin matrix monomers that adhere to hydrogen ions, resulting in the formation of pores on the composite resin's surface.[7] The hydrogen ions in the acidic water will ionise through these pores and diffuse into the restorative material immersed in the acidic solution.[21–26]

Based on the study's findings, it was determined that the hypothesis was valid since the microhybrid composite resin's roughness changed after being soaked in fermented milk for one, four, and seven days. In light of this, patients who have microhybrid composite resin fillings and have consumed fermented milk for the past five years may be informed that these fillings have a tendency to have surface roughness. This is particularly true if the filling is placed on the anterior or posterior teeth, where it may compromise aesthetics.

One limitation of this study is that the immersion procedure was performed at room temperature and did not simulate intraoral temperature conditions (approximately 37°C). Therefore, the results may not fully represent the actual conditions in the oral cavity. In addition, because the immersion solution was not refreshed during the experiment, there is a possibility that some volatile compounds or small molecules in the fermented milk evaporated during prolonged exposure, which may have affected the chemical stability of the solution. Furthermore, the samples were not analyzed using a scanning electron microscope (SEM), so the surface morphology and roughness changes of the microhybrid composite resin after immersion for 1, 4, and 7 days could not be directly observed.

CONCLUSION

The microhybrid composite resin's surface roughness increased significantly after it was immersed in a fermented milk solution until the seventh day. Resin matrix degradation, acid exposure, soaking time, hydrolysis, solubility, and water absorption all contribute to variations in resin roughness.

REFERENCES

1. Miletic V. Dental composite materials for direct restorations. Springer; 2018.
2. Setyowati L, Chandra J. Surface roughness of nanofilled and nanohybrid composite resins exposed to kretek cigarette smoke. Dent J (Majalah Kedokt Gigi). 2018;
3. Firdausy MD. Surface Deterioration Of Gic Type II Based On Its Expiration Date After Immersion In Carbonated Drink. Odonto Dent J. 2019;6(2):99–106.
4. Sukma, A; Kurnia, YF; Purwati E. Potensi Lactobacillus fermentum PE2 Isolat Bakteri Asam Laktat Asal Dadih Kabupaten Lima Puluh Kota dan Pangan Lokal Sari Wortel Dalam

Pembuatan Susu Fermentasi Sebagai Pangan Fungsional. Laporan Penelitian Riset Dasar, Universitas Andalas. Padang. 2019.
5. Albarran-Martínez L, Rodríguez-Vilchis LE, Contreras-Bulnes R, Moyaho-Bernal M de LA, Teutle-Coyotecatl B. Effect of different industrialized acid beverages on the surface roughness of flowable composite resins: in vitro study. J Clin Pediatr Dent. 2023;47(5):152–61.
6. Fadewi FB, Erlita I, Saputera D. Surface roughness of bulk-fill resin-based composite restorative materials after immersion in probiotic milk. Dentino J Kedokt Gigi. 2019;4(2):124–9.
7. Puspitasari SA, Siswomiharjdo W, Harsini H. Perbandingan kekasaran permukaan resin komposit nanofiller pada perendaman saliva pH asam. J Mater Kedokt Gigi. 2016;5(2):15–9.
8. Riffenburgh RH, Gillen DL. Statistics in medicine. United States: Academic press; 2020.
9. Yilmaz E, Mujdeci A. The Effect of Mouthrinses on Surface Roughness of Two Nanohybrid Resin Composites. Brazilian Dent Sci. 2021;24(2):1–10.
10. Itanto BSH, Usman M, Margono A. Comparison of surface roughness of nanofilled and nanohybrid composite resins after polishing with a multi-step technique. In: Journal of Physics: Conference Series. IOP Publishing; 2017. p. 12091.
11. Maharani AS, Aditama P, Indrastuti M, Saleh S. Effect of Silica Coating In Acrylic Artificial Teeth On Surface Roughness, Contact Angle, and Growth of Streptococcus Mutans. Odonto Dent J. 2021;8(2):106–12.
12. Diansari V, Sundari I, Dani SP. Kekasaran Permukaan Resin Komposit Nanofiller Setelah Paparan Perasan Jeruk Nipis (Citrus Aurantifolia). Cakradonya Dent J [Internet]. 2022;14(1):8–13. Available from: http://dx.doi.org/10.24815/cdj.v14i1.27295
13. Nurmalasari A. Perbedaan kekasaran permukaan resin komposit nano pada perendaman teh hitam dan kopi. J Wiyata Penelit Sains dan Kesehat. 2017;2(1):48–53.
14. Anusavice KJ. Phillips' Science of Dental Materials (Anusavice Phillip's Science of Dental Materials) [Internet]. 11th ed. Vol. 12, Elsevier Saunders. USA: Elsevier; 2021. 275–293 p. Available from: https://www.elsevier.com/books/phillips-science-of-dental-materials/shen/978-0-323-69755-2
15. Tandrayuana FA. Perbedaan Lama Perendaman Air Perasan Jeruk Nipis (Citrus Aurantifolia Swingle) Terhadap Kekasaran Permukaan Resin Komposit Nanohybrid (Penelitian Eksperimental Laboratoris). Universitas Airlangga; 2016.
16. Elwassefy N, ElEmbaby A, Elkholany N. Correlation between surface roughness and color stability of nano-and micro-hybrid resin composites using different surface treatment protocols. Egypt Dent J. 2023;69(1):705–13.
17. Chowdhury D, Mazumdar P, Desai P, Datta P. Comparative evaluation of surface roughness and color stability of nanohybrid composite resin after periodic exposure to tea, coffee, and Coca-cola–An in vitro profilometric and image analysis study. J Conserv Dent Endod. 2020;23(4):395–401.
18. El-Rashidy AA, Shaalan O, Abdelraouf RM, Habib NA. Effect of immersion and thermocycling in different beverages on the surface roughness of single- and multi-shade resin composites. BMC Oral Health [Internet]. 2023;23(1):367. Available from: https://doi.org/10.1186/s12903-023-03069-w
19. Phanestu TH, Syafiar L. Surface Roughness of Nanofiller Composite Resin after Immersion in Black Tea. In: 11th International Dentistry Scientific Meeting (IDSM 2017). Atlantis Press; 2018. p. 225–9.
20. Liliany D, Violetta V. Effect of soft drink on surface roughness of preheated and non-preheated nanohybrid composite resins. J Indones Dent Assoc. 2020;3(2):83–7.
21. Basri MHC, Erlita I, Nahzi MYI. Kekasaran permukaan resin komposit nanofiller setelah perendaman alam air sungai dan air pdam. Dentino J Kedokt Gigi. 2017;2(1):101–6.
22. Camilotti V, Detogni AC, Ambrosano GMB, Mendonça MJ, Ueda JK, De Goes MF. Effect of acidic solutions present in the diet on the surface roughness of microhybrid composite resins. Res Soc Dev. 2022;11(4):e46111426588–e46111426588.
23. Pribadi N, Soetojo A. Effects of different saliva pH on hybrid composite resin surface roughness. Dent J (Majalah Kedokt Gigi). 2011;44(2):63–6.
24. Malik A, Kothari AK, Dave R, Rao V V, Vyas K, Agrawal DP, et al. Comparative Evaluation of Surface Roughness of Different Composite Restorative Materials after Thermocycling and Prolonged Immersion in Common Beverages Using Atomic Force Microscopy—In Vitro Study. J Pharm Bioallied Sci [Internet]. 2024;16(Suppl 4). Available from: https://journals.lww.com/jpbs/fulltext/2024/16004/comparative_evaluation_of_surface_roughness_of.72.aspx
25. Alp CK, Gündogdu C, Ahısha CD. The Effect of Gastric Acid on the Surface Properties of Different Universal Composites: A SEM Study. Scanning. 2022;2022:9217802.

26. Szczesio-Wlodarczyk A, Sokolowski J, Kleczewska J, Bociong K. Ageing of Dental Composites Based on Methacrylate Resins—A Critical Review of the Causes and Method of Assessment. Vol. 12, Polymers. 2020. p. 882.