THE EFFECT OF CHILD TOOTHPASTE CONTAINS *Sodium Lauryl Sulfate* (SLS) AND NOT CONTAINS *Sodium Lauryl Sulfate* (NON-SLS) ON PRIMARY TEETH ENAMEL SURFACE ROUGHNESS

(PENGARUH PASTA GIGI ANAK DENGAN Sodium Lauryl Sulfate (SLS) DAN TANPA Sodium Lauryl Sulfate (NON-SLS) PADA KEKASARAN PERMUKAAN ENAMEL GIGI SULUNG)

Henri Hartman[1*], Hartanto Endrowahyudi[2], Jeffrey[1], Rahmadaniah Khaerunnisa[3], Salsabila Auza[4]
[1]Departement of Pediatric Dentistry Department, Faculty of Dentistry, Universitas Jenderal Achmad Yani, Cimahi, Indonesia
[2]Department of Conservative Dentistry, Faculty of Dentistry, Universitas Jenderal Achmad Yani, Cimahi, Indonesia
[3]Department of Oral Biology, Faculty of Dentistry, Universitas Jenderal Achmad Yani, Cimahi, Indonesia
[4]Faculty of Dentistry, Universitas Jenderal Achmad Yani, Cimahi, Indonesia

*Corresponding author
henri.hartman@lecture.unjani.ac.id

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ABSTRACT

Brushing teeth combined with toothpaste is influential in maintaining dental and oral hygiene, especially for children still developing. Toothpaste contains several active ingredients, including detergent in the form of *Sodium Lauryl Sulfate* (SLS). This study aims to determine whether or not using children's toothpaste that contains SLS and does not contain SLS on the enamel surface roughness. An experimental laboratory study was conducted on twenty primary incisors divided into two groups of treatment samples to be brushed using toothpaste containing SLS and not SLS. Toothbrushing treatment was carried out

for 30 days in the morning and evening with the assumption that the accumulated time for 6 minutes was the same as the time to brush your teeth in 1 day, 2x brushing your teeth in the morning and at night. The tooth enamel surface roughness was measured before and after treatment in the middle 1/3 of the labial surface using a Mituyo SJ 301 profilometer. Statistical analysis using the Dependent *t-Test* showed that the P-value of the enamel surface roughness variable was less than 0.05 (P-value <0.05), thus it can be explained that there is a statistically significant mean difference between the enamel surface roughness variables before and after brushing treatment on both groups. Toothpaste that contains SLS and without SLS affects the enamel surface roughness, which can reduce the enamel surface roughness.

Keywords: enamel surface roughness; *sodium lauryl sulfate*

ABSTRAK

Penyikatan gigi disertai penggunaan pasta gigi sangat penting untuk diperhatikan dalam pemeliharaan kesehatan gigi dan mulut anak dan remaja. Pasta gigi terdiri dari berbagai macam bahan, salah satunya adalah Sodium Lauryl Sulfate (SLS). Tujuan penelitian ini adalah untuk menentukan perbedaan penggunaan pasta gigi dengan kandungan SLS dan tanpa SLS. Penelitian dilakukan secara eksperimental terhadap 20 gigi insisif sulung yang terbagi menjadi dua kelompok penelitian. Kelompok pertama diberikan perlakuan penyikatan dengan pasta gigi SLS, sedangkan kelompok kedua diberikan perlakuan penyikatan dengan pasta gigi non-SLS. Penyikatan dilakukan selama 30 hari sebanyak dua kali sehari pada saat pagi dan malam hari. Kekasaran enamel gigi diukur sebelum dan sesudah perlakuan pada area 1/3 permukaan labial menggunakan profilometer Mituyo SJ 301. Hasil penelitian memperlihatkan perbedaan yang signifikan (p <0.05) antara gigi yang disikat menggunakan pasta SLS dan non-SLS dalam menyebabkan perubahan kekasaran enamel, namun diantara keduanya tidak memberikan perbedaan yang terlalu berarti.

Kata kunci: *kekasaran permukaan enamel; sodium lauryl sulfate*

INTRODUCTION

According to the 2018 Indonesian Basic Health Research report data, the prevalence of dental caries in Indonesia reached 45.3%, with most caries sufferers from children. The prevalence of the caries rate in West Java, according to the same report data, reached 45.66%. The most significant number occupied by the age group 3-14 years, which reached 15,495 people, have dental caries.[1- 3]

Instilling a sense of maintaining dental and oral health in children needs to be done as early as possible. The simple way to introduce children to taking care of oral health was brushing their teeth in the morning after breakfast and before going to bed. Brushing their teeth cannot be separated from the vital role of parents who constantly encourage their children to brush their teeth using a toothbrush and toothpaste.[4- 9.]

Toothpaste widely circulated in Indonesia contains sodium lauryl sulfate (SLS), a chemical detergent to produce foam when brushing your teeth. The standard sodium lauryl sulfate (SLS) limit in one children's toothpaste is 1-2%. If the excess is over that value, it can cause decreased sensitivity to taste, irritation of the oral mucosa, ulceration, and decreased salivary solubility, impacting the salivary flow rate. This decrease in salivary flow rate can interfere with saliva's function as self-cleaning, affecting the cleanliness of the oral cavity and teeth of children.[10-13]

Previous research has revealed a lot of damage to the oral soft tissue due to the content of *sodium lauryl sulfate* (SLS) in toothpaste. This study was dedicated to knowing the effect of *sodium lauryl sulfate* (SLS) on the hard tissues of teeth, especially enamel surface roughness.

METHOD

The research method used an analytical, experimental study design using pre- and post-test designs. The sampling technique in this study was a consecutive sampling method, with inclusion criteria, primary incisors, primary incisors without caries, no abrasion/erosion, and no dental abnormalities. The exclusion criteria were teeth that have been restored and fractured teeth. The number of samples for this study was calculated using the minimum sample size formula according to Sopiyudin Dahlan (2011)14, a paired numerical

comparative research formula. The sample size for each group was ten primary incisors, with a total sample of twenty primary incisors. The incisors were divided and labelled into two groups: group 1 treatment with non-sodium lauryl sulfate (SLS) toothpaste and group 2 treatment with *sodium lauryl sulfate* (SLS) toothpaste. The primary incisors were cleaned with water and then soaked in a 10% formaldehyde solution for disinfection for approximately one week. Enamel surface roughness before treatment was measured in the middle one-third of the buccal part of the primary incisor by using a surface roughness tool known as

A profilometer (Mituyo SJ 301), the width measurement area was accomplished at 0.5 mm vertically parallel to the long axis of the tooth three times with a speed of 0.25 mm. After the initial measurement results were recorded, it was followed by immersion of the primary incisors using artificial saliva to create a state of the teeth like in the oral cavity environment and keep the teeth moist. Brushing was done every morning and night, with a vertical brushing technique in 6 seconds for 30 days. Group 1 does not contain *sodium lauryl sulfate* (SLS), and group 2 uses toothpaste *sodium lauryl sulfate* (SLS). After brushing, both groups of samples were allowed to stand for 60 seconds before rinsing with running water.

After rinsing under running water the sample finish, all samples were put back into the jar containing artificial saliva and allowed to stand until the next tooth brushing. Treatment was given for 30 days. Re-measure the enamel surface roughness after treatment using a Profilometer with a Mituyo SJ 301 in the exact measurement and setting methods as before the treatment. This research has been carried out at the Bandung Manufacturing Polytechnic Laboratory in December 2021 - January 2022. Roughness value data were processed using statistical applications. Before the statistical test was carried out, the data was assessed with the *Shapiro-Wilk* test for normality, then continued with a significance test to compare the two research groups using a paired *t-Test* if the data were normally distributed and the *Mann-Whitney* test if the data were generally not distributed.

Meanwhile, statistical analysis to compare the research groups before and after treatment using paired *t-Test* if the data were normally distributed and the *Wilcoxon* test as an alternative if the data were not normally distributed. This research has obtained ethical approval from the Health Ethics Commission of the Faculty of Medicine, Padjadjaran University, with letter number

64/UN6.KEP/EC/2022.

RESULT

Table 1 describes the description of the enamel surface roughness before treatment, the enamel surface roughness after treatment and the difference in the decrease in enamel surface roughness. For enamel surface roughness before treatment had an average of 1.68 ± 0.389, enamel surface roughness after treatment had an average of 0.58 ± 0.154, and the difference in decreasing enamel surface roughness had an average of 1.10 ± 0.441.

Table 1. Overview of Research Subject Characteristics

Variable	N=20
Enamel Surface Roughness Before Treatment	
Mean±Std	1.68±0.389
Median	1.71
Range (min-max)	0,89-2,52
Enamel Surface Roughness After Treatment	
Mean±Std	0.58±0.154
Median	0.54
Range (min-max)	0.35-0.90
The difference in Decrease in Enamel Surface Roughness	
Mean±Std	1.10±0.441
Median	1.15
Range (min-max)	0.36-2.17

Table 2. Comparison of enamel surface roughness after treatment in the SLS and non-SLS toothpaste groups

Variable	Toothpaste		Z test (*Mann Whitney*)	P-Value
	SLS N=10	Non - SLS N=10		
Enamel Surface Roughness After Treatment			-1.589	0.123
Mean±Std	0.64±0.147	0.52±0.147		
Median	0.66	0,49		
Range (min-max)	0.43-0.88	0.35-0.90		

Table 2 compares the enamel surface roughness after treatment in the SLS and non-SLS toothpaste groups. After treatment in the SLS toothpaste group, the enamel surface roughness value had an average of 0.64 ± 0.147. In contrast, after treatment in the SLS toothpaste group, the enamel surface roughness had an average of 0.52 ± 0.147. The analysis of numerical data was tested using the Mann-Whitney test because the data were not normally distributed on the enamel surface roughness variable after treatment. The results of statistical tests in the research group above-obtained information on the P value of the enamel surface roughness variable after it was more significant than 0.05 (P value> 0.05), which means it is not significant or statistically not significant, thus it can be explained that there is no significant difference in the mean between the enamel surface roughness variable after treatment in the SLS toothpaste group and those that did not contain SLS.

Table 3. Comparison before and after treatment of enamel surface roughness on teeth using SLS toothpaste

Variable	Groups		T (T-test)	P-Value
	Before N=10	After N=10		
Enamel Surface Roughness			**7.649**	**<0.001***
Mean±Std	1.67±0.408	0.64±0.147		
Median	1.71	0.66		
Range (min-max)	0.89-2.34	0.43-0.88		

Table 3 describes the roughness comparison between before and after treatment of enamel surface roughness on teeth using SLS toothpaste. The enamel surface roughness value before treatment had an average of 1.67±0.408, while the enamel surface roughness after treatment had an average of 0.64±0.147. It was tested using a paired T-Test to analyze numerical data because the data were normally distributed. The alternative was Wilcoxon's enamel surface roughness test if the data were not normally distributed. The results of statistical tests in the research group above-obtained information on the P value of the enamel surface roughness variable less than 0.05 (P value <0.05) which means statistically significant or significant, thus it can be explained that there is a statistically significant mean difference between enamel surface roughness variable before and after treatment on teeth using SLS toothpaste.

Table 4. Comparison before and after treatment of enamel surface roughness on teeth using toothpaste that does not contain SLS

Variable	Groups		Z test (Wilxocon)	P-Value
	Before N=10	After N=10		
Enamel Surface Roughness			**-2.803**	**0.005***
Mean±Std	1.69±0.390	0.52±0.147		
Median	1.67	0.49		
Range (min-max)	1.08-2.52	0.35-0.90		

Table 4 compares before and after treatment of enamel surface roughness in patients using toothpaste that did not contain SLS. The enamel surface roughness value before treatment had an average of 1.69±0.390, while the enamel surface roughness after treatment had an average of 0.52±0.147. This numerical data analysis was tested using the Wilcoxon test because the data were not normally distributed, namely the surface roughness of the enamel. The results of statistical tests in the research group above-obtained information on the P value of the enamel surface roughness variable less than 0.05 (P value <0.05) which means statistically significant or significant, thus it can be explained that there is a statistically significant mean difference between enamel surface roughness variables before and after

roughness treatment on teeth using toothpaste that did not contain SLS.

DISCUSSION

The results of the analysis on the comparison before and after treatment of enamel surface roughness on teeth using SLS toothpaste in Table 3 follow the results of research conducted by Abdillah (2018)[15], which explains that SLS can damage the hydroxyapatite structure and also damage the collagen content in dentin. It can reduce the enamel surface roughness.[15]

Table 4 shows a significant difference between the SLS toothpaste treatment group and those that do not contain SLS. This result exists because there are several other factors besides the ingredients of toothpaste that can affect the roughness of the teeth, as reported by research conducted by Rahmavidyanti (2021)[16], which states that the selection of the type of toothbrush can also influence the surface roughness of the teeth. The type of toothbrush bristle, the frequency and pressure applied when brushing teeth can also affect the surface roughness of the teeth. The decrease of enamel surface roughness in the toothpaste group that did not contain SLS could occur due to other factors which not only come from the toothpaste content.[16]

However, a study conducted by Mohamed Shamel (2019)[17], which has examined several whitening toothpaste' effect on enamel surface roughness of the enamel, shows different average results with a significant difference between before and after treatment, both increased or decreased. With surface changes in the form of fine scratches, surface irregularities, few pores, and scratches became more apparent. It was due to differences in the composition of different abrasives in each toothpaste.[17]

S.Salzer (2016)[18], in his research on the effectiveness of toothpaste without and with sodium lauryl sulfate on the plaque, gingivitis and gingival abrasion, stated that toothpaste with and without SLS was as effective on gingival health and plaque index scores in the oral cavity.[18] Based on the table of research results, it can be stated that there was a decrease in the number of enamel surface roughness in the two treatment groups using SLS toothpaste and without SLS. Statistically, the result was insignificant ($p>0,05$), with a more significant reduction in the enamel surface roughness achieved by SLS toothpaste. This result could happen apart from the toothpaste content, which was the primary concern. Still, other factors can also influence the enamel surface roughness, such as the selection of a toothbrush and the way they use it while brushing.

For future consideration, we

suggest exploring more research using only *sodium lauryl sulfate* (SLS) material to avoid misconduct with other toothpaste ingredients and make sure of the effect of SLS on tooth enamel surface roughness. It was also necessary to do further research to observe the effect of *sodium lauryl sulfate* (SLS) toothpaste on enamel surface roughness at different times.

CONCLUSION

According to the research that has been carried out, it can be simplified that toothpaste containing *sodium lauryl sulfate* (SLS) and without *sodium lauryl sulfate* (SLS) reduces the enamel surface roughness of primary incisors. Statistically ($p<0,05$), the enamel surface roughness of primary teeth that were treated with *sodium lauryl sulfate* (SLS) toothpaste showed a more significant decrease in enamel surface roughness compared to those that did not contain *sodium lauryl sulfate* (SLS).

CONFLICT OF INTEREST

We declare no potential conflict of interest in the scientific articles we write.

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REFERENCES

1. Kementerian Kesehatan RI. InfoDATIN kesehatan gigi nasional september 2019. Pusdatin Kemenkes RI. 2019;1–6.
2. Kemenkes RI. Hasil riset kesehatan dasar tahun 2018. Kementrian kesehatan RI. 2018;53(9):94.
3. Kementerian Kesehatan RI. Laporan provinsi Jawa Barat, Riskesdas 2018. Lembaga penerbit badan penelitian dan pengembangan kesehatan. 2019. 140–151 p.
4. Ibrahim, Roni. Implementasi manajemen promosi kesehatan dalam menurunkan karies gigi pada anak. J Ilm Kesehat Iqra. 2018;6(2):95–103.
5. Tandelilin RTC, Setiawan PB, Mugiwardani A. Kerapatan fasilitas kesehatan tingkat 1 berdasarkan permasalahan kesehatan gigi dan mulut di provinsi daerah istimewa Yogyakarta. J Kesehat Vokasional. 2020;4(4):190.
6. Casamassimo, Fields, Mctigue N. Pediatric dentistry infancy through adolescence. 4th edition. Riverport Lane: Elsevier.; 2013. p 29–290.
7. Ria N. Gambaran pengetahuan dan perilaku anak dalam memelihara kesehatan gigi dan mulut terhadap terjadinya karies molar satu permanen pada murid kelas iii dan iv sd negeri 067247 jl. Bunga malem vii kelurahan lau

cih kecamatan medan tuntungan. J Ilm PANNMED (Pharmacist, Anal Nurse, Nutr Midwivery, Environ Dent. 2019;12(3):285–91.

8. Simaremare SA. Gambaran tingkat pengetahuan ibu tentang menyikat gigi terhadap terjadinya karies pada siswa/i kelas ii sd azizi kecamatan medan tembung. J Ilm PANNMED (Pharmacist, Anal Nurse, Nutr Midwivery, Environ Dent. 2019;12(3):292–6.

9. Nagauleng A, Pengetahuan ibu tentang pemeliharaan kesehatan gigi dan mulut pada anak. JIKI J Ilm Kesehat IQRA [Internet]. 2018;6(1):2089–9408. Available from: https://stikesmu-sidrap.e-journal.id/JIKI/article/view/55

10. Wawo EB, Wowor PM, Siagian K V. Uji pengaruh penggunaan pasta gigi dengan kandungan detergen sodium lauryl sulfate terhadap kecepatan alir saliva pada masyarakat di desa walantakan. Pharmacon. 2016;5(4):46–51.

11. Brown RS, Smith L, Glascoe AL. Inflammatory reaction of the anterior dorsal tongue presumably to sodium lauryl sulfate within toothpastes: a triple case report. Oral Surg Oral Med Oral Pathol Oral Radiol. 2018 Feb 1;125(2):e17–21.

12. Green A, Crichard S, Ling-Mountford N, Milward M, Hubber N, Platten S, et al. A randomized clinical study comparing the effect of Steareth 30 and SLS containing toothpastes on oral epithelial integrity (desquamation). J Dent. 2019 Jan;80 Suppl 1:S33–9.

13. Sridhar P. Manual of Pediatric Dentistry. 1st edition. New Delhi: Jaypee Brothers Medical Publishers.; 2014. 75–80 p.

14. Dahlan MS. Statistik untuk Kedokteran dan Kesehatan: Deskriptif, Bivariat, dan Multivariat. 3rd edition. Jakarta: Salemba Medika.; 2013. p 159.

15. Nasution AI, Gani BA, Asbarini F. Topografi dentin setelah penyikatan dengan sodium lauryl sulfate pada berbagai durasi waktu ditinjau dengan atomic force microscopy dentin Topography After Brushed Within Sodium Lauryl Sulfate in Several Durations Assessed By atomic force microscopy. Cakradonya Dent J [Internet]. 2018;10(1):31–7. Available from: http://e-repository.unsyiah.ac.id/CDJ/article/view/10613

16. Ilmu D, Gigi K, Kedokteran F, Universitas G. Studi laboratoris pengaruh pasta gigi charcoal dan whitening terhadap kekasaran permukaan enamel. 2021;5(1):414–23.

17. Shamel M, Al-Ankily MM, Bakr MM. Influence of different types of whitening tooth pastes on the tooth color, enamel surface roughness and enamel

morphology of human teeth [version 1; peer review: 3 approved]. F1000Research. 2019;8:1–16.

18. Sälzer S, Rosema NAM, Martin ECJ, Slot DE, Timmer CJ, et al. The effectiveness of dentifrices without and with sodium lauryl sulfate on plaque, gingivitis and gingival abrasion-a randomized clinical trial. [cited 2021 Aug 17]; Available from: www.random.org