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Comparing Fluoride Varnish, Fissure Sealant and Ozone for Children Caries Prevention

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ABSTRACT

Background: Caries is the most prevalent oral health disease in children globally. Well-known method such as fluoride varnish and fissure sealant has been used to prevent caries overtime. Ozone therapy considered as a new innovation in caries prevention for children which has not been studied much for its effectiveness compared to the other popular method. **Objective:** This review aimed to compare caries preventive methods with fluoride varnish (FV), fissure sealant (FS) and ozone (O) for children and decide which method is the most effective. **Literature Study:** PubMed, SpringerLink, EBSCOhost and Science direct were searched from December 2021 to January 2022. The criteria included all randomized controlled trials and clinical trials comparing the caries preventive effect between FV, FS and O on children's permanent teeth. **Discussion:** A total of 12 articles were included. Regarding dentin caries prevention, 2 studies found resin FS in favour of no FS and 2 studies found FV in favor of controls. 1 study agreed glass ionomer FS and no FS comparable. 3 studies agreed FV and FS were comparable. 1 study agreed resin FS and glass ionomer FS comparable. 1 study also found FV, FS and O comparable. Regarding dentin remineralization, 2 studies found O were comparable with FS dan calcium hydroxide base. These methods are safe for children. **Conclusion:** Fluoride varnish, fissure sealant and ozone are effective in preventing children's caries with their own benefits and drawbacks. None of the methods is superior over another as there were a variety of the data reported.

Keywords: Caries Prevention, Children, Fissure Sealant, Fluoride Varnish, Ozone.

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INTRODUCTION

Caries is a multifactorial disease that arises from environmental interaction, habits and genetic factors. Caries involve a complex process of remineralization and demineralization of enamel caused by acid produced by microorganisms inhabiting the dental plaque.¹ Caries is the most prevalent oral health disease in children around the world. The World Health Organization (WHO) stated caries incidence in children is around 60-90%.² Indonesia Basic Health Research (Riskesdas) also stated that in 2018 as much as 92,6% children aged 5-9 in Indonesia had caries.³ These events seemed to be far from the target WHO had set in 2020 to achieve 80% of children in the world to be free from caries.⁴

Children tend to be exposed to caries as the anatomical structure of the teeth and early eruption time make it difficult to cleanse by the younger children.⁵ As they get older, children with caries in their primary teeth are prone to have higher risk to develop caries in their permanent teeth.⁶ Caries prevention is important for children, as the caries experience in children will be a strong indicator for future caries risk.⁷ Tickle M divides evidence based intervention to prevent caries into three big categories: lowering the frequency and intake of carbohydrate, maintaining the balance of remineralization and demineralization and sealing the teeth from acid.⁸

An initiation to increase favorable conditions in the oral cavity to prevent caries can be done by the use of fluoride. Topically application of fluor inhibits the absorption of salivary proteins on the enamel surface, thereby inhibiting formation of pellicle and plaque as well as increasing resistance of enamel to acids by creating a fluorapatite layer which is stronger against demineralization.⁹ Fluoride varnish is a topical fluoride that is considered sufficient to protect children with moderate to high caries prevalence. It is indicated as a prevention program for children with active caries and as an

alternative treatment before fissure sealant placement is adequate.¹⁰ Fluoride varnish is recommended for children as it is easy and fast to apply.¹¹ It works by releasing fluoride gradually over time and only a little amount of products needed to protect the whole tooth.¹² However, there are some drawbacks of using fluoride varnish including reversible tooth discoloration, risk of acute toxicity and the unpleasant taste that is declined by children.⁶

Other caries prevention initiation can be done by protecting teeth from acids produced by bacteria using fissure sealants. Fissure sealant is a resin material that is placed on the occlusal surface of the tooth as a barrier, preventing the growth of biofilm and accumulation of debris that can form caries in the molars groove.¹³ Disadvantages encountered when applying fissure sealants are that proper fluid control techniques are required and there are risk that it will come off and become worn overtime.¹⁴

In the 21st century new alternatives for caries prevention have emerged, one of which is ozone therapy. Ozone as a caries treatment agent in certain amounts is powerful enough to stop caries, even for a deep caries lesion. Ozone not only kills microorganisms on the tooth surface, but also destroys their biomolecular residues.¹⁵ Ozone application itself does not provide any additional benefit for caries prevention, it only creates a 'clean' environment that can prevent caries from developing further.¹³ This therapy can be an option for anxious children and as an alternative to restorative treatment using an invasive bur.¹⁶

In the past study, Kalnina et al¹⁷ conducted a clinical trial comparing prevention of occlusal caries in Latvia children with interventions of fluoride varnish, fissure sealant and ozone. This study concluded the three caries prevention agents were recommended to prevent occlusal caries, but there was no significant difference in the effectiveness of the three agents. The researcher explained that there is still no literature study that compares the three materials.

The author is interested to research and seek further information on this topic, because there was still no evidence based study that compared ozone effectiveness with another widely used method for caries prevention, such as fissure sealant and fluoride varnish using literature review approach.

LITERATURE STUDY

The type of research used is literature review with a rapid review approach. The articles reviewed derived from PubMed, SpringerLink, EBSCOhost and Science direct databases that met the following criteria:

1. Articles that discuss the effect of fluoride varnish, fissure sealant and ozone for caries prevention
2. Articles with children having an erupting or fully erupted permanent teeth
3. Articles with randomized controlled trials and clinical trials design
4. Articles published in the last ten years
5. Articles in English

Articles that full text was not available, in the form of narrative review, case report or case series, articles with children who have certain health problems and non-human participants were excluded from this study.

Articles were searched from December 2021 to January 2022 using combination of the keywords “fluoride varnish”, “fissure sealant”, “ozone”, “caries” and “children”, with added conjunctions “AND” and “OR” to specify the search results. Filtering menus in each database were used. The results of the articles obtained were then filtered using the PRISMA (Preferred Reporting Items for Systematic Review and Meta-Analysis). Eligible articles are then extracted and analyzed based on the outcomes measured in the study. The strength of recommendations will be evaluated using SORT (Strength of Recommendation Taxonomy).¹⁸

The subjectivity risk assessment of the articles were reviewed using the Cochrane risk of bias tool version 2.¹⁹ The risk of bias will be

assessed based on 5 domains: bias arising from the randomization process, bias due to deviation from intended intervention, bias due to missing outcome data, bias in measurement of the outcome and bias in selection of the reported outcomes. Furthermore, the overall risk of bias will be presented in the form of traffic light graphs.

DISCUSSION

A total of 1,073 articles were obtained from the databases. Thirty-three articles were excluded, as they were duplicates. A total of 1,040 articles were screened from titles and abstracts; 972 articles did not fit the purpose then excluded. Furthermore, 55 articles were read in full text. Twelve articles were found to meet the eligibility criteria then included in qualitative analysis.

Articles covered were mostly from China and Brazil, with three articles each. The study designs included randomized controlled trials, randomized clinical trials, clinical trials and longitudinal clinic studies with parallel or split mouth methods. Research study periods range from 12 to 36 months. The results of the articles identified from this rapid review is illustrated in the PRISMA flow chart in Figure 1.

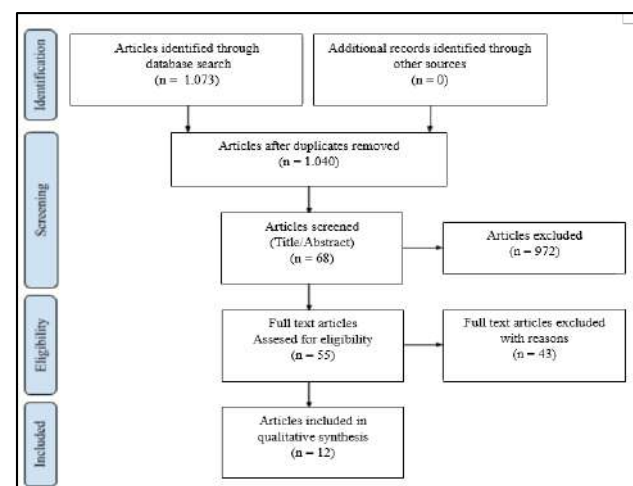


Figure 1. PRISMA flow chart diagram

Based on the evaluation of the quality of evidence using SORT, the strength of

recommendation for this study was B (moderate). Two articles had good quality, patient-oriented scientific evidence (level 1) and five articles had limited quality scientific evidence, patient-oriented (level 2). Subjectivity

risk assessment results showed seven out of twelve articles reviewed had some concerns regarding their overall risk of bias. Summary of the data extracted from the articles reviewed presented in Table 1.

Table 1. Summary of the data extracted from the included study

Researcher (Year)	Title	Location	Study Design	Level of Evidence	Risk of Bias
Arruda et al (2012)	Effect of 5% fluoride varnish application on caries among school children in rural Brazil: A randomized controlled trial	Brazil	Randomized controlled trial	3	Some concerns
Liu et al (2012)	Randomized trial on fluorides and sealants for fissure caries prevention	China	Randomized clinical trial	2	Some concerns
Muller-Bolla et al (2013)	Effectiveness of school-based dental sealant programs among children from low-income backgrounds in France: a pragmatic randomized clinical trial	France	Randomized clinical trial	1	Low risk
Oliveira et al (2013)	Comparison of the caries-preventive effect of a glass ionomer sealant and fluoride varnish on newly erupted first permanent molars of children with and without dental caries experience	Brazil	Longitudinal clinic study	3	High risk
Liu et al (2014)	Glass ionomer ART sealant and fluoride-releasing resin sealant in fissure caries prevention-results from a randomized clinical trial	China	Randomized clinical trial	2	Low risk
Unal et al (2015)	Remineralization Capacity of Three Fissure Sealants with and without Gaseous Ozone on Non-Cavitated Incipient Pit and Fissure Caries	Turkey	Clinical trial	3	Some concerns
Kalnina et al (2016)	Prevention of occlusal caries using a ozone, sealant and fluoride varnish in children	Latvia	Clinical trial	3	High risk
Chestnutt et al (2017)	Fissure Seal or Fluoride Varnish? A Randomized Trial of Relative Effectiveness	UK	Randomized controlled trial	2	Some concerns
Safwat et al (2017)	Clinical Evaluation of Ozone on Dentinal Lesions in Young Permanent Molars using the Stepwise Excavation	Egypt	Randomized controlled clinical trial	3	Some concerns
Wu et al (2020)	Effectiveness of fluoride varnish on caries in the first molars of primary schoolchildren: a 3-year longitudinal study in Guangxi Province, China	China	Randomized controlled trial	2	High risk
Hesse et al (2021)	Atraumatic Restorative Treatment-Sealed versus Nonsealed First Permanent Molars: A 3-Year Split-Mouth Clinical Trial	Brazil	Clinical trial	2	Some concerns
Tahani et al (2021)	Fissure sealant therapy as a portable community-based care in deprived regions: Effectiveness of a clinical trial after 1 year follow-up	Iran	Randomized clinical trial	1	Some concerns

This study included a total of 5.125 randomized participants. Participants' ages ranged from five to fourteen, including both

male and female gender. The articles reviewed included children with caries-free permanent first molars or that had early

caries lesion with ICDAS (International Caries Detection and Assessment Score) code 1-2 which already fully erupted or were in the eruption stage, healthy, cooperative and had high caries risk. The article excluded children who had been under medication in the last 3 weeks, allergic to colophony, using orthodontic appliances and following other clinical trials.

Majority of caries prevention test materials were applied to the permanent first molars. Only one articles applying material on the permanent premolars¹⁷.

The types of fissure sealants studied were resin, fluoride-releasing resin and glass ionomer. Fissure sealant was applied to the occlusal, occlusal-buccal and occlusal-palatal surface. Two articles^{20,21} used conventional glass ionomer sealant with finger press technique, while the other two^{22,23} used packable glass ionomer sealant.

Fluoride varnish was applied on the entire tooth surface or selective only to the occlusal, occlusal-buccal and occlusal palatal surfaces. The fluoride varnish content covered is 5% sodium fluoride and 0.1%

difluorsilane with doses ranging from 0.4 to 0.5 mL per application. Fluoride varnish applications were repeated every follow-up period.

The type of ozone studied in the articles covered was gaseous, which is applied on the entire surface of the molar teeth with a silicone tipped pen-like device. The length of gas exposure ranged between 6 and 40 seconds. After the application, a remineralizing solution was applied on two articles^{17,24} studied.

Criteria for assessing caries level for majority of the articles were carried out by recording dentinal caries lesions (ICDAS code 3-6) at the final examination, changes in DMFT (Decayed, Missing and Filled Teeth) or DMFS (Decayed, Missing and Filled Surface for permanent teeth) scores and decreased DIAGNOdent™ score. Articles with fissure sealant intervention also measured sealant retention rates and correlated them with caries rates.

Summary of the characteristics of all the articles reviewed presented in Table 2.

Table 2. Summary of the characteristics of all the articles reviewed

Researcher (year) Duration	Initial Sample (Finals)	Age	Evaluation of the Material Delivery Method	Caries Assessment Criteria/ Index (Calibration)	Type of Material Analyzed	Main Findings
Arruda et al (2012) 12 months	379 (210)	7-14	Tooth brushing, drying, isolation, varnish application on all tooth surface, post application instructions	ICDAS criteria and caries experience in permanent tooth (DFS score) by 4 calibrated examiners (Kappa 0.59-0.93)	Fluoride varnish, 5% NaF–sodium fluoride (Cavity Shield®), 2 times/ year Placebo varnish, 2 times/ year	1. Varnishes group has lower DFS index than placebo group 2. Caries reduction up to 40% with NaF varnish 3. Two annual applications of varnishes reduce caries significantly compared to two annual placebo application 4. None of side effect reported

Liu et al (2012) 24 months	501 (482)	7-11	Sealant applied to occlusal FPM ICDAS 0-2, light cured Isolation, varnish application on occlusal FPM, post application instructions	Caries development into dentin (ICDAS 4-6) and sealant retention by calibrated examiner (Kappa > 0.9)	Fluoride-releasing resin sealant (Clinpro®), baseline Fluoride varnish, 5% NaF (Duraphat®), 2 times/ year 38% SDF solution (Saforide®), 2 times/ year Placebo control, 2 times/ year	1. Dentinal caries incidence on three intervention groups were lower than control group 2. Caries reduction rate of NaF varnish 39%, SDF 41% and resin sealant 60% 3. The three intervention groups have similar efficacy to prevent pit and fissure caries on FPM 4. Complaints of bitter taste after SDF application
Muller-Bolla et al (2013) 12 months	276 (253)	6-7	Sealant applied on occlusal FPM ICDAS 0-2, given oral hygiene and caries education	Caries incidence (ICDAS 3-6) marked with D ₃ - ₆ MFT and d ₃ - ₆ mft, sealant retention by calibrated examiner (Kappa 0.75 and 0.88)	Resin sealant (Delton Plus®), baseline Control, without intervention	1. FPM with sealant were lower at risk of developing new caries compared to control group 2. Caries reduction as of 74% with resin sealant 3. Sealant retention 52.7%, lower rates on upper jaw 4. None of side effect reported
Oliveira et al (2013) 24 months	80	6-8	Prophylaxis using pumice, sealant applied on occlusal-palatal/ occlusal-buccal FPM using micro brush Varnish applied on occlusal-palatal/ occlusal-buccal 0,5 mL dose/ application	Enamel and dentin caries with visual and tactile methods, sealant retention using Simonsen criteria by 2 examiners. No information of examiner's calibration	Pink glass ionomer sealant (Fuji Triage®), baseline Fluoride varnish NaF 5% (Durafluor®), 2 times a year	1. Teeth sealed using GI sealants develops more caries than fluoride varnish 2. 70% of caries lesions originated from group with previous caries experience (primary teeth) 3. Caries prevention effect of GI sealant and

						fluoride varnish were comparable 4. GI sealants has bad retention, only one sealant retained fully at the end of studies
Liu et al (2014) 24 months	280 (261)	7-9	Isolation, sealant applied on occlusal FPM ICDAS 0-2, light cured Isolation, sealant applied using finger press technique	Dentinal caries (ICDAS 4-6) and sealant retention by 2 calibrated examiners (Kappa > 0.88)	ART GI sealant (Ketac-Molar Easymix®), baseline Fluoride releasing-resin sealants (Clinpro®), baseline 38% SDF solution, 2 times/ year Fluoride varnish, 2 times/ year	1. More dentin caries proportion on ART GI sealants, compared to resin sealant (not significant) 2. Sealant retention (full and partial) is better significantly on resin sealants (75%) than ART GI sealants (52%) 3. ART sealant and resin sealant are comparable to prevent caries fissure for 24 months 4. None of side effect reported
Unal et al (2015) 12 months	60 (167)	7-9	Gaseous ozone application using HealOzone generator on FPM surface 615 cm ³ /min 40 seconds, then remaining gas vacuumed for 10 seconds Aegis® and Heliaseal® sealants applied by pressing to tooth surface, Fuji® sealant in packable capsules	Caries remineralization evaluation with DIAGNOdent™, retention sealant by 2 calibrated examiners (Kappa 0.88 and 0.93)	Ozone gas, 40 sec + sealant (Aegis®, Fuji®, Heliaseal®), 4 times/ year Control: Sealant only, baselines: Resin sealants amorphous calcium phosphate (Aegis ACP®), GI sealant (Fuji Triage®),	1. Gaseous ozone application followed with Fuji® and Aegis® sealant are effective in caries remineralization (decreased DIAGNOdent™ score), whereas Heliaseal® does not 2. Triage® has the worst retention compared to other sealants with resin ingredients significantly (Aegis® and Heliaseal®)

					fluoride-releasing resin sealant (Helioseal®)	3. Gaseous ozone application before sealant placement does not influence sealant retention 4. Sealant with or without gaseous ozone does not have significant influence on dentin and enamel structure
Kalnina et al (2016) 12 months	122 (107)	10	Varnish applied on occlusal premolar permanent for 1 minute, post procedure instruction Prophylaxis, isolation, etching, sealant applied on occlusal premolar permanent Gaseous ozone 6 seconds on occlusal premolar permanent, remineralization agent 1 minutes, post procedure instruction	Occlusal caries with DMFT index changes, OHI-S index, bitewing, sealant retention. No information of examiner's calibration	Fluoride varnish, (Fluocal solute®), 2 times/ year Resin sealant (Clinpro 3M®), baseline Ozone gas (Prozone®), 6 seconds + remineralizing solution, 2 times/ year Control without intervention	1. DMFT index on all group increased after 12 months (not significant) 2. OHI-S index decreased after 12 months 3. Occlusal caries rate among test groups are not significantly different 4. The three test groups are not significantly different on their effectiveness to prevent occlusal caries
Chestnutt et al (2017) 36 months	1016 (835)	6-7	Isolation, sealant applied on occlusal FPM Isolation, varnish applied on entire FPM surface dose <0.4 mL	New caries developed to D ₄₋₆ MFT, sealant retention by calibrated examiner (Kappa 0.82 and 0.89)	Resin sealant (Delton®), baseline Fluoride varnish, 5% NaF (Duraphat®), 2 times/ year	1. Children proportion with dentin caries on their FPM after 36 months are not significant, FS 19.6% and FV 17.5% 2. Resin sealants has fairly good retention, 75.4% intact 3. FV is comparable with FS resin to prevent caries

						4. None of side effect reported
Safwat et al (2017) 12 months	81	7-9	Local anesthesia, isolation, tooth cleaning, stepwise excavation, application of ozone gas with HealOzone generator silicon tip for 40 seconds, the remaining gas vacuumed 10 seconds, remineralizing solution (group 2 only)	DIAGNOdent™ score, caries visual and tactile examination by calibrated examiner (Kappa 0.92)	baseline, split mouth divided into: Group I: Ozone gas 40 seconds (Ia), control base Ca(OH) ₂ (Ib) Group II: Ozone gas 40 seconds + remineralizing solution (pH Balancer®) 2 ml, 5 seconds (IIa), control base Ca(OH) ₂ (IIb) Intervention temporary sealed until final evaluation	1. No significant difference in dentin color and consistency after ozone application with or without remineralizing solution 2. No significant different among ozone and calcium hydroxide group on dentin color and consistency 3. DIAGNOdent™ value decreased significantly after ozone gas application with and without remineralizing solution 4. Ozone application with or without remineralizing solution has no significant effect to dentin color and consistency after caries excavation
Wu et al (2020) 36 months	2003 (1748)	6-8	Tooth brushing, dried, isolation, applied with 0.4 mL varnish on entire teeth surface, post procedure instruction	Caries prevalence with modified ICDAS, caries development towards dentin (ND01-ND03), DMFT, DMFS by 2 calibrated examiners (Kappa inter-examiner 0.85, intra-examiner 0.84)	Fluoride varnish, 5% NaF (Duraphat®) + oral hygiene instruction, 2 times/year Control, given oral hygiene education, 2 times/year	1. Fluoride varnish group has lower caries prevalence, caries development, DMFT and DMFS score compared to control group (significant) 2. None of side effect reported 3. 5% NaF application capable to prevent caries on FPM and recommended as school-based

						prevention program
Hesse et al (2021) 36 months	187 (153)	6-8	Tooth brushing, isolation, sealant applied with ART technique on occlusal FPM, petroleum jelly application over the sealant	Caries ICDAS 4-6, sealant retention, changes in DMFT/dmft score by 4 calibrated dental students (Kappa inter-examiner 0.85-0.94 and intra-examiner 0.70-0.90)	Vertical split mouth ART GI sealant (Fuji IX®), baseline ART GI sealant (Maxxion®), baseline Control without sealant	1. No significant different on caries development with ART sealants 2. Sealant retention not related with dentinal caries development 3. Children with caries experience at baseline has higher risk on developing caries 4. ART sealant is not more effective than no sealant to reduce FPM dentinal caries
Tahani et al (2021) 12 months	124 (109)	7-9	Prophylaxis, isolation, etching, sealant applied on occlusal-buccal FPM, light cured, fluoride varnish applied on entire teeth, oral hygiene instructions	Caries incidence (ICDAS code 3-6) and sealant retention by 2 calibrated examiners (Kappa 0.82)	Split mouth Resin fissure sealant (Prime Dent®) + fluoride varnish (Asia Chemi Tab®), baseline Control without sealant	1. Caries incidence on teeth without sealant is three times bigger 2. Sealant full retention 41.4% and partially 27.2% 3. There is relationship between sealant retention with new caries incidence 4. Caries reduction by 67% with resin sealant

In this study, the caries prevention effect was categorized based on the measured research outcomes. Based on their ability to prevent dentinal caries, fluoride varnish and fissure sealant (resin and glass ionomer) were effective and comparable in two articles^{22,25}. One article²¹ showed that resin and glass ionomer fissure sealant were comparable in preventing fissure caries. Two

other studies^{26,27} showed a significantly higher caries prevention rate with resin sealants compared to teeth without sealants. Two studies showed fluoride varnish had significant effect on caries reduction compared to placebo²⁷ or oral health education²⁸ alone. One study²⁰ showed glass ionomer sealants were not

significantly different in preventing dentin caries compared to no intervention.

There is only one study¹⁷ which compared caries prevention ability between resin fissure sealant, fluoride varnish and ozone which conclude these three interventions had similar efficacy in preventing occlusal caries. Another study also found resin fissure sealant, fluoride varnish and SDF (silver diamine fluoride)²⁹ were not much different in preventing caries from progressing into dentin.

Two studies with ozone, measured the caries prevention effect from the degree of remineralization and the state of dentin (hardness and color) changes. Unal et al²³ which studied ozone application prior the placement of three types of fissure sealants (containing fluoride-releasing resin, glass ionomer and amorphous calcium phosphate) showed a decrease in DIAGNOdent™ score, but not significant. When being compared with sealant only control group, there was no

significant difference of DIAGNOdent™ score between the sealant group with ozone gas or without ozone gas. Another study by Safwat et al²⁴, showed ozone gas with or without additional remineralizing solution did not have a major effect on the color and hardness of dentin. DIAGNOdent™ scores decreased in the ozone group, but were not significant compared to the calcium hydroxide base control.

There were no articles that show one intervention is superior over another by significant difference. There is only evidence of effective caries prevention with fluoride varnish and fissure sealant when being compared with no intervention. A total of six articles^{15,21,25,26,28,28} reported no complaints or side effects experienced by children after the intervention of fissure sealant, fluoride varnish or ozone.

The outcome results of the articles reviewed are summarized in Table 3.

Table 3. Summary of the research outcome

Research Summary		Effective	Not significantly different
Based on ability to prevent dentinal caries (occlusal/pit and fissure caries)	Resin sealant vs. fluoride varnish GI (glass ionomer) sealant vs. fluoride varnish Resin sealant vs. ART GI sealant Resin sealant vs. no intervention	Muller-Bolla (2013), Tahani (2021) Arruda (2012), Wu (2020)	Chestnutt (2017) Oliveira (2013) Liu (2014)
	GI sealant vs. no intervention Fluoride varnish vs. control/placebo		Hesse (2021)
	Resin sealant vs. fluoride varnish vs. ozone gas Resin sealant vs. fluoride varnish vs. SDF		Kalnina (2016) Liu (2012)
	TOTAL	4 studies	6 studies
Based on dentinal remineralization ability	Ozone gas + resin/GI sealant vs. resin/GI sealant Ozone gas + remineralizing solution vs. calcium hydroxide base	-	Unal (2015) Safwat (2017)
	TOTAL		2 studies

DISCUSSION

Overall, the findings from this literature review showed that fissure sealant, fluoride varnish and ozone are effective in preventing caries by their own respective ways, especially in children's first permanent molars (FPM). Fissure sealant is the most widely published intervention method in the articles covered in this study.

Fissure sealants have been proven effective in preventing new caries and able to stop caries development. Two studies with randomized split mouth design for 12 months showed that first permanent molars treated with sealants had a lower risk of dentinal caries^{26,27} and had three times greater caries risk in the group without sealant²⁷. The observed caries reduction rate ranged from 12-74%. Similar results was found in the systematic review by Ahovuo-Saloranta et al³² which found 11-51% caries reduction on the teeth treated with resin sealants after 24 months. There is a relationship between sealant retention after one year and the incidence of new caries. Sealant retention was found to be good in both studies (52.7% and 41.2%), which could be the reason for the low caries rate in the resin sealant group.

Three clinical trials^{22,23,29} comparing fissure sealants with fluoride varnish, concluded that these two methods are comparable in preventing caries. This finding is supported by a recent systematic review by Kashbour et al³³, this study also states that there is no superior method between the two.

Research conducted by Chestnutt et al²⁵ with resin sealants showed a higher caries rate than Oliveira et al²² study using glass ionomer sealants, although the retention rate of resin sealants tested better than glass ionomer sealants. This contradicts the statement that there is a relationship between sealant retention and the incidence of caries alone.²⁷ This could be attributed to differences in the study period conducted.

The resin sealant was studied for 36 months, much longer than the 24 months study with glass ionomer sealants. Caries tend develop more on the teeth because of the longer research period.³⁴

Effectiveness of glass ionomer sealants in preventing caries does not depend entirely on their retention ability.³⁵ Glass ionomer sealants also have an advantage to release fluoride over time into the oral cavity.⁶ A study in Turkey with 4 years period, concluded an increase in salivary fluoride levels after application of a glass ionomer sealant, which is thought to be capable of preventing caries and induce remineralization.³⁵ In addition, even when this type of sealant has completely disappeared clinically, a small portion of the sealant will still remain in the fissure's depth and continues to release fluoride.³⁶

A study comparing two types of sealants was carried out by Liu et al²¹ by comparing fluoride-releasing resin sealants and glass ionomer sealants. In this clinical trial, found that the two types of sealants were comparable in preventing fissure caries with molar survival rates of 93% and 96%, respectively. The caries prevention rate is slightly better on fluoride-releasing resin sealants. This may relate to the fact that fluoride-releasing resin sealants have better retention in this study. However, this does not make fluoride-releasing resin sealants superior to glass ionomer sealants. Similar findings showing that fluoride-releasing resin sealants are slightly superior to glass ionomer sealants have also been reported in other clinical trials.^{37,38} There is no high-quality evidence comparing the two types of sealants.

Several things that can be considered when selecting the type of sealant used are whether or not adequate equipment is available and the patient's level of cooperation.³⁹ Placement of sealant with conventional method (finger press) is the

most preferred for used in remote areas with limited tools. Other caries prevention methods, such as fluoride varnish can also be carried out under limited equipment conditions.

Application of a fluoride varnish containing 5% sodium fluoride twice a year is an effective and safe method to prevent caries incidence in the first permanent molars of children with high caries risk, compared to controls without intervention.⁴⁰ The included 12-month randomized controlled trial showed a decrease in DFS/DMFS score levels up to 49%²⁸ and 58.9%³⁰, respectively. The DMFS score decrease of the two studies was greater than the systematic review of Marinho et al⁴⁰ which showed an average DMFS score reduction of 43%. This is understandable as a systematic review included many articles with different initial caries levels, hence it may be a confounding variable for the study. The caries prevention rate of fluoride varnish plus oral hygiene education showed better results; therefore, it could be considered as a beneficial additional intervention.

Ozone is a new caries prevention method that has not been widely studied. Clinical trials in children with caries comparing ozone gas with control interventions were included in this study. One study²³ comparing the application of ozone before sealant with control sealant alone in children aged 7-9, found that ozone had no effect on sealant retention success, but was able to prevent incipient caries when used in conjunction with sealants containing calcium phosphate or fluoride. A study by Çelik et al⁴¹ with sectioned third molars showed a similar result. In that study, the application of ozone gas before the placement of fissure sealant was also not affecting the enamel bond strength of a giomer-based fissure sealant and recommend the use of ozone as a pretreatment disinfectant before sealant application.

A study examining ozone with or without remineralizing solution compared to calcium hydroxide base control alone²⁴, showed that ozone gas applied to dentin after excavation of damaged tissue in deep carious dentin lesions did not significantly affect the hardness and color of the dentin of young permanent molars after 12 month. Similar results were obtained in the in vitro lab tests of Duggal et al⁴² and Tahmassebi et al⁴³. Those studies reported the application of ozone alone was not effective enough to protect enamel from demineralization and provide remineralization, if not combined with remineralizing solution. There were no recent studies on the effectiveness of ozone as a caries prevention agent in children with better evidence.

Up until this research was conducted, there was only one clinical trial¹⁷ comparing fissure sealant, fluoride varnish and ozone. This study was conducted in a developing country, assessed to have high risk of bias and poor strength of recommendation as the study was disease oriented. That study stated the three methods were effective and not much different to prevent occlusal caries.

This literature study chose good quality evidence derived from randomized controlled trials and clinical trials only to avoid high risk of bias. Interventions were also chosen to be carried out directly on human subjects to provide a factual effect with an actual state of oral cavity and selected the last ten years literature, hence the data obtained had an element of novelty.

Based on the assessment of SORT recommendation, the majority of articles reviewed were limited quality clinical trials with a patient-oriented outcome (Level 2), therefore the strength of recommendation for this study is B (moderate).

Based on the subjectivity risk assessment conducted using Cochrane risk of bias version 2, the overall risk of bias in this study is considered to have some concerns.

The domain of bias with the worst criteria is bias arising from deviation from intended intervention with 50% (6 of 12 articles) considered to have some concerns. These related to several studies that were not reporting the allocation process and randomization sequences, and not blinding both participants and/or operators.

The result of the subjectivity risk assessment is presented in the traffic light graph reported in Graph 1.

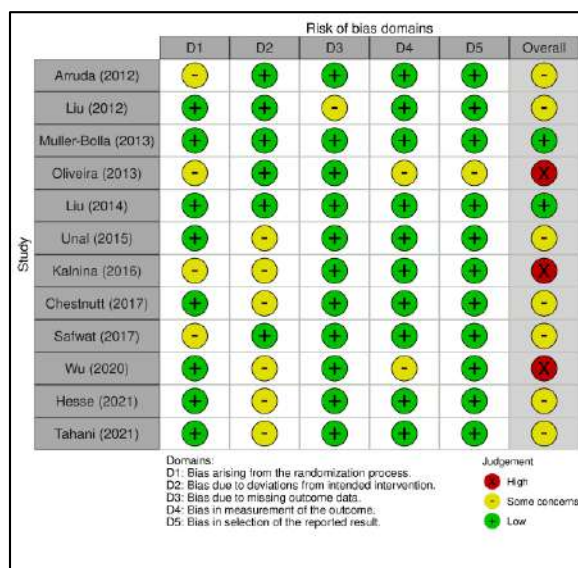


Figure 2. Traffic light of the risk of bias assessment result

The limitations of this rapid review, namely the diversity of data obtained due to combination of various comparisons of interventions and parameters used to measure caries, as well as differences in inclusion and exclusion criteria that varied in all articles. The majority of articles reviewed also reported presence of confounding variables outside the study that could affect the study results. The disproportionate number of articles between interventions also creates some problems. The lack of articles with ozone intervention gives limited results, hence it cannot provide a more valid result.

Majority of articles reviewed are disease oriented and are not focusing on

intervention effects directly to the patient's quality of life. In addition, evaluation of subjectivity risk showed more than half of the articles reviewed had some concerns. The presence of bias in a study can cause it to be less reliable and has probability that the following outcome is interfered with by the subjects involved.

The three caries prevention methods using fluoride varnish, fissure sealant and ozone are effective in preventing caries in children with their respective advantages and disadvantages. None of the methods is superior over another as there were a variety of the data articles reported.

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Differences in Maxillary and Mandibular Premolar Length Distortion at Various Angulation Angles of Periapical Radiographs

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ABSTRACT

Background: Periapical radiographic techniques are usually used in root canal treatment. Distortion on bisecting technique periapical radiographs is relatively more common, especially on premolars located at the curved jaw area. **Objective:** To determine the difference in the length distortion of the maxillary and mandibular premolars at various exposure angles of periapical radiographs. **Methods:** The research conducted using observational analytic research, and the research design is cross-sectional. The sample used in this study were 30 upper premolars X-rayed using the periapical bisecting technique with a reference angle from the first literature book +30 and a reference angle from the second literature book +40 and 30 lower premolars X-rayed at -10 and -15 angles. **Results:** On the independent sample T-test, p value < 0.05 for both the upper and lower premolars, so it can be concluded that there is a significant difference in distortion with a reference angle of +30 and +40 on upper premolars and -10 and -15 reference angles on the lower premolars. **Discussion:** Distortion of periapical radiographs with bisecting technique occurs more easily. The placement of the periapical sensor must be as close as possible to the object so that the correct position of the periapical sensor also plays a role in the formation of distortion. **Conclusion:** There is a significant difference in the length distortion of the upper and lower premolars on the angle of exposure periapical bisecting radiographs from the two reference books.

Keywords: Angulation angle, Bisecting, Periapical, Premolars

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INTRODUCTION

The periapical technique is widely used because it is more detailed, cheaper, and simpler than the panoramic technique.¹ Periapical radiographic techniques are usually used in root canal treatment because inaccurate working length measurements can lead to inadequate debridement and underfilling of the root canals.² Radiographic examination also has an important role in identifying the configuration of the root canal.³

The position of the premolars in the jaw is located between the anterior and posterior regions, which is located at the curve of the jaw arch, making it relatively difficult to place films in the mouth for intraoral radiography. Distortion in the bisecting technique is relatively more common in periapical radiographs, especially in premolars located at the angle of the jaw, so research is needed to determine the amount of vertical angle that can be tolerated to achieve minimal distortion.⁴ The bisecting technique is often used in dental practice but has drawbacks distortion often occurs due to vertical and horizontal angle errors.⁵

Several studies have discussed that the position of the radiographic apparatus is closely related to the radiographic geometry.⁶ Whaites and Drage, in their book, mention the angle in the bisecting technique for the lower premolars is -15° , and for the maxillary region of the premolars is $+40^\circ$.⁷ Meanwhile, White and Pharoah, in their book, mention the angle in the bisecting technique for the lower premolars is -10° and for the maxillary premolars is $+30^\circ$.⁸ Purpose of this study is to determine the difference in the length distortion of the maxillary and mandibular premolars to the angle of radiograph taking based on references from White and Pharoah as well as Whaites and Drage in the jaw model of FKG UMY students.

MATERIALS AND METHODS

This research is an analytic observational study with a cross sectional research design. This study used an analytic research design to determine the difference in distortion of tooth length to the angle of radiograph taking according to reference books. The samples used were 30 upper premolars and 30 lower premolars after extraction with intact conditions, the length of the teeth was measured using a sliding caliper and determined as the length of the natural teeth. The sample teeth were implanted in a jaw model made of jaw prints on Faculty of Dentistry, Universitas Muhammadiyah Yogyakarta students. The jaw model using original molds from students is intended to simulate the upper jaw according to the shape of the patient's palate and the lower jaw to simulate the depth of the base of the patient's mouth.

The jaw model that has been implanted with premolars is then positioned so that the occlusal plane of the jaw to be x-rayed is parallel to the horizontal plane. Place the size two periapical sensor from Vistascan Mini Easy Durr Dental in the arch as close as possible to the object. Position the Veraview iX Morita periapical X-ray tube cone with the tilt angle according to the reference and the LED alignment position guide point right on the cervical of the premolars.

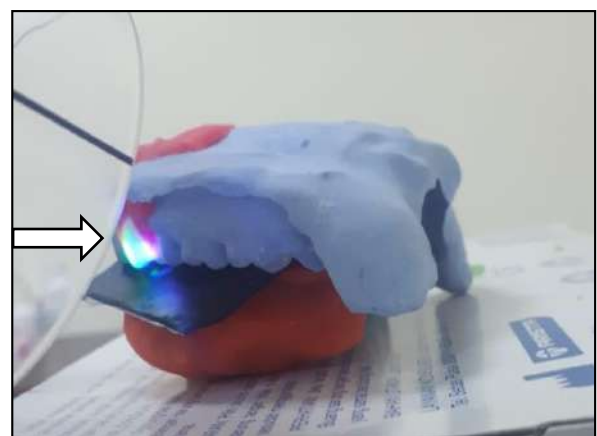


Figure 1. The LED Alignment position guide is positioned on the cervical premolars (arrows)

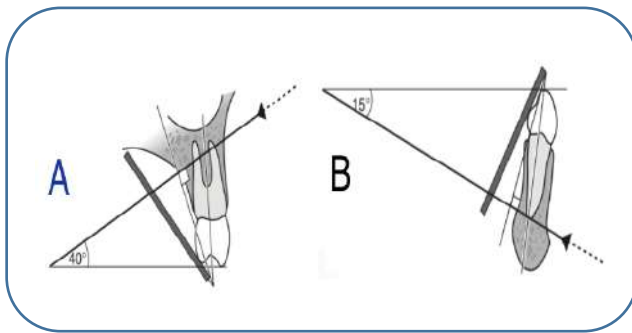


Figure 2. Reference angle for taking radiographs according to Whites and Drag. A. Upper premolars. B. Lower premolars.⁷

Angulation Guidelines for Bisecting-Angle Projections		
Projection	Maxilla	Mandible
Incisors	+40 degrees	-15 degrees
Canines	+45 degrees	-20 degrees
Premolars	+30 degrees	-10 degrees
Molars	+20 degrees	-5 degrees

Figure 3. Reference angle for taking radiographs according to White and Pharoah.⁸

The length of the teeth on the radiograph was measured using the DBSWIN software. The magnitude of the distortion in this study is the difference between the tooth length measurements on the radiograph and the original tooth length.

RESULT

This research was conducted at the Dental Hospital of the University of Muhammadiyah Yogyakarta using samples of the original upper and lower premolars implanted in a jaw model. This research was conducted at the Dental Hospital of the University of Muhammadiyah Yogyakarta using samples of the original upper and lower premolars implanted in a jaw model.

Table 1. Mean distortion and standard deviation (SB) of premolar length

$\bar{X}$	Upper Premolar		Lower Premolar	
	Angle (°)	Distortion (mm) $\pm$ SD	Angle (°)	Distortion (mm) $\pm$ SD
Reference by White	30	2.1607 $\pm$ 0.44213	-10	0.6043 $\pm$ 0.10016
Reference by Whaites	40	1.1073 $\pm$ 0.29367	-15	0.4873 $\pm$ 0.06762

Table 1 shows that the reference angle from White and Pharoah produces a larger average distortion than the reference angle from Whites and Drage. The existing data is then tested to determine whether the data is normally distributed, as shown in Tables 2 and 3.

Table 2. Normality test on samples of upper premolars.

Tests of Normality		Kolmogorov-Smirnov ^a		Shapiro-Wilk	
Angles		Statistic	df	Statistic	df
Upper Premolar	Reference by White	.106	30	.200*	30
	Reference by Whaites	.150	30	.082	30

Table 3. Normality test on samples of lower premolars.

Tests of Normality		Kolmogorov-Smirnov ^a		Shapiro-Wilk	
Angles		Stat	df	Stat	df
Lower Premolar	Reference by White	.140	30	.932	30
	Reference by Whaites	.151	30	.079	30

Tables 2 and 3 show that the value of the degrees of freedom (df) for each group is 30, so the normality test uses the Shapiro-Wilk technique. Sig. value in each group, both upper and lower premolars > 0.05, the data is normally distributed so that an analysis can be carried out using the Independent-Samples T-Test to determine the significance of the difference in the mean in each group.

Table 4. Independent-Samples Test on upper premolars

Independent Samples Test		Levene's Test for Equality of Variances					t-test for Equality of Means	
		F	Sig.	t	df		Sig. (2-tailed)	
Upper Premolar	Equal variances assumed	7.188	.010	10.870	58		.000	
	Equal variances not assumed			10.870	50.420		.000	

Table 5. Independent-Samples Test on lower premolars

Independent Samples Test		Levene's Test for Equality of Variances					t-test for Equality of Means	
		F	Sig.	t	df		Sig. (2-tailed)	
Lower Premolar	Equal variances assumed	10.071	.002	5.303	58		.000	
	Equal variances not assumed			5.303	50.886		.000	

Variances for the upper premolars was 0.010 and for the lower premolars was 0.002, both <0.05 , this means that the variance of the data in each group of reference angles is not homogeneous, so the interpretation of the Independent samples Test output table is guided by the values contained in line Equal variance not assumed.⁹ Sig. (2-tailed) of $0.000 < 0.05$, it can be concluded that there is a statistically significant difference in the distortion of the length of the upper and lower premolars to the reference angle according to White and Pharoah and Whaites and Drage.

DISCUSSION

This study aimed to determine the difference in the magnitude of the tooth length distortion concerning several vertical angles according to references from 2 literature books. The average magnitude of distortion in maxillary

premolars is greater than that of mandibular premolars. The difference in reference angle between the top and bottom is also greater in the upper premolars. Besides that, several other studies have also proven that the maxillary teeth experience more vertical angle errors than the mandible.^{10,11}

The results of the T-test from the research data on both the upper and lower premolars show that there is a significant difference. These differences can happen because changes in the vertical angle have a very important role in the results of projected objects onto the film sensor. Other researchers also stated that the bisecting periapical radiograph distortion occurs more easily, so the angulation angle needs to be considered.¹² Placement of the periapical sensor must be as close as possible to the object so that the correct position of the periapical sensor also has a role in the formation of distortion. For the maxilla, the placement of the periapical sensor is influenced by the curvature of the palate, and for the mandible, it is influenced by the floor of the mouth.⁸ In general, the position of the X-ray source, the object, and the film's location affects the distortion of the periapical radiograph.¹³

A vertical angle that is too large will result in a shortened image of the teeth on the radiograph and vice versa. If the vertical angle is too small, the teeth will elongate.¹⁴ According to other researchers, the distortion in radiographs is caused by incorrect film placement, an incorrect irradiation angle setting, and increased object film distance.² Reference vertical angles are provided as approximations only. The difference in patients, in this case, is that the arch of the maxilla and the floor of the mouth in the mandible have different conditions that affect the tilt of the periapical sensor placement. The recommended vertical angulation is only a general guide.⁷ The position of the teeth in the arch also affects the distortion. Teeth have different inclinations or slopes in the buccal-lingual direction, so the inclination in the buccal-lingual direction also affects the amount of

distortion. The position of the individual teeth varies so that each patient's angle of periapical radiograph taking must be assessed independently.⁷

CONCLUSION

Based on the results of this study, it can be concluded that there is a significant difference in the distortion of the length of the maxillary and mandibular premolars concerning the angle of periapical radiograph taken according to references from White and Pharoah and Whaites and Drage.

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Prevalence of Gingivitis With Intensity of Control Fixed Orthodontic Patients During The Covid-19 Pandemic in Medical Students in Surabaya

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ABSTRACT

Background: Periodontal health is an important factor used to evaluate the success of orthodontic treatment. Complications that occur in periodontal treatment are reported as one of the most common side effects associated with orthodontics. **Objective:** To determine the relation between the prevalence of gingivitis and the checkup intensity of fixed orthodontic patients during the COVID-19 pandemic. The periodontal complication associated with orthodontics is gingivitis. **Methods:** This research was combining cross-sectional method and analytical observation involving students of the Faculty of Medicine Surabaya who were treated as fixed orthodontic patients in the period May-June 2022 as samples. **Results:** The data analysis used in this study was the Chi-Square statistical test. The results reveal that the relation between the control intensity and gingivitis incidence is significant in the case of fixed orthodontic patients who took regular control at the Faculty of Medicine, Universitas Wijaya Kusuma, Surabaya. The prevention of gingivitis is done by maintaining the hygiene of the dental and oral cavity. The intensity of routine check is done to provide patients with additional information on how to maintain oral hygiene and how to use the hygiene tools useful for preventing traumatic stomatitis. **Conclusion:** In the case of fixed orthodontic patients, in the era of Covid-19 pandemic, there is a significant relation between the patient's checkup intensity and the prevalence of gingivitis.

Keywords: Gingivitis, Intensity, Control orthodontics.

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INTRODUCTION

The purpose of orthodontic treatment according to Graber and Swain is to get the best possible results for each individual. These goals include improvement of facial esthetics, arrangement of teeth, static occlusion relationship and good function. One of the ways to achieve this goal is the use of fixed orthodontics.¹

Periodontal health is an important factor used to evaluate the success of orthodontic treatment. Complications that occur in periodontal treatment are reported as one of the most common side effects associated with orthodontics. The periodontal complication associated with orthodontics is gingivitis.²

From research conducted by Ardiansyah et al, 2019 stated that first-year students at the Faculty of Medicine and Health Sciences users of fixed orthodontic devices had status with mild criteria and plaque factors as well as excessive pressure factors due to orthodontic appliances. Fixed adhesions are the main cause of gingivitis.³

Research conducted by Shenoi, et al., 2020 regarding the effect of increasing COVID-19 cases makes patients feel anxious to make visits, especially clinics or hospitals, 19.6% of patients choose to postpone routine care visits until the COVID-19 pandemic is resolved. The study showed that patients realized the importance of routine care but patients preferred to postpone treatment due to anxiety about COVID-19.⁴

In the normal era, patients routinely check with an orthodontist, this can control the patient's oral hygiene status. However, as the pandemic progresses, the level of control compliance decreases and as a result, the oral hygiene status is uncontrolled and can result in the accumulation of food debris and plaque on the surface of the teeth. This resulted in the prevalence rate of gingivitis increasing compared to the prevalence rate of gingivitis in the pre-pandemic era.

From the above delineation, researchers are interested in carrying out a study on the gingivitis incidences in relation with the control intensity of fixed orthodontic patients. This study aims at examining the level of prevalence of gingivitis that can be caused if the patient is not controlled periodically during the covid-19 pandemic.

METHODS

This research is combining cross-sectional research method and analytical observation. The samples of the study were 37 students of the Faculty of Medicine, Universitas Wijaya Kusuma, Surabaya who were under in the period May-June 2022 . This study using parameters of gingival index and uses descriptive bivariate statistical analysis to see the relationship between the dependent and independent variables using Fisher's test with a degree of significance value = 0.05.

RESULTS

Table 1. Sample distribution based on gender

Gender	Quantity (person)	Percentage (%)
Female	34	90 %
Male	3	10%
Total	37	100

Source: Research Data, 2022

As shown in Table 1, the samples consist of 34 females (90%) and 3 males (10%). In Table 2, most samples are 19, 20 and 21 years old with the numbers of each age category are 9 people (25%) and the lowest age category is 15 years old which is only 1 person (2.5%).

Table 2. Sample distribution based on age

Age (Years Old)	Amount (person)	Percentage (%)
15	1	2,5 %
18	3	7,5 %
19	9	25 %
20	9	25 %
21	9	25 %
22	6	15 %
Total	37	100

Source: Research Data, 2022

Table 3. Sample distribution based on length of orthodontic treatment

Length of Orthodontic Treatment	Quantity (person)	Percentage (%)
≤ 2 years	11	35 %
> 1 year	26	65 %
Total	37	100

Source: Research Data, 2022

In Table 3, 65% of the samples (26 samples) have been under orthodontic treatment for more than 1 year but less than 2 years. The rest (35%) has been under the treatment for more than 2 years.

Table 4. Sample distribution based on control intensity

Control Intensity	Amount (person)	Percentage (%)
Seldom	3	7,5 %
Often	28	77,5 %
Always	6	15 %
Total	37	100

Source: Research Data, 2022

Table 4 shows the description of respondents based on length of use, Seldom >4-6 weeks, Often ≤ 5 weeks, Always ≤ 4 weeks, that the majority of samples (77.5%) are through the routine checkup during their treatment. It confirms Kawabata & Danta's opinion that the patients always go to their routine control.

Table 5. Gingival Index Score Table

Category	Indication	Scor
Normal	No inflammation	0
Mild	Slight change in color and texture, no bleeding when performed.	1
Moderate	Redness, edema, bleeding when performed	2
Severe	Redness, edema, ulceration and spontaneous bleeding	3

Source: Research Data, 2022

Based on table 5, the category scores of gingivitis index are 0 for normal gingiva; 0,1 - 1 for Mild inflammation; 1,1 - 2 for Moderate inflammation; and 2,1 - 3 for Severe inflammation.

Table 6. The correlation between prevalence of gingivitis and control intensity of fixed orthodontic patients during the covid-19 pandemic

Control intensity	Gingiva index			Amount		P
	mild	Moderate	Severe	F	%	
Seldom	1 14,3 %	2 28,6	4 57,1 %	7	18,9%	0.03
Often	15 62,5 %	8 33,3%	1 4,2 %	24	64,9 %	
Always	3 50%	2 33,3	1 16,7 %	6	16,2 %	
Amount	19 51,4 %	1 32,4	6 16,2 %	37	100 %	

Based on table 6, shows that there is a relation between the prevalence of gingivitis and the control intensity, as corroborated by a significance level of <0.05.

DISCUSSIONS

The majority of samples in the study were women (36 samples). Women tend to do orthodontic treatment more often on aesthetic grounds. Women tend to Table 6. Relationship of Prevalence gingivitis based on intensity of control their teeth as they age. Most women do not have enough self confidence when they do not maintain their oral hygiene.⁵

In this study, the longest duration of using of fixed orthodontic devices was > 1 year. These results show that on average, students of the Faculty of Medicine, Universitas Wijaya Kusuma, Surabaya have used fixed orthodontic devices for a long period of time. Most of the samples in this study had a constant control intensity (1-2 months) during the COVID-19 pandemic, namely 31 respondents (82.5%). These results are not in line with research conducted by Bustati et al (2020), which revealed that there was a tendency that patients with orthodontic treatments prefer to delay their visits during the COVID-19 pandemic as they were worried to get infected. However, the research conducted by Martina et al (2021) was in line with the stipulation of the new normal provisions and the vaccination program so that the anxiety to carry out routine controls in patients with orthodontic treatment was reduced.^{6,7}

Gingival health status in patients undergoing orthodontic treatment is not only influenced by dental and oral hygiene, but can also be influenced by orthodontic appliance pressure, gender, age, duration of use and regularity of control over users of fixed orthodontic appliances.⁵ Orthodontic control is performed to check the movement of patients' teeth, examine the fixed orthodontic devices, inspect the orthodontic improvement, and solve some patients' complaints during the treatment. In general, orthodontic checkup is able to maintain gingival health in fixed orthodontic patients.⁸ Gingivitis is an inflammation that involves the soft tissue around the teeth, namely the tooth tissue.⁹ Gingivitis is a mild form of periodontal disease with clinical signs in the form of red, swollen and easy-to-bleed gingiva without any evidence of alveolar bone damage.¹⁰

In this study, it was found that there was a relation between the gingivitis incidence and the control intensity ($P > 0.05$). The result confirms the research conducted by Diah et al (2019) which presented that users of fixed orthodontic appliances with healthy gingival

criteria were more commonly found in respondents who carried out checkup according to the specified schedule. The intensity of routine checkup allows dentists to fix orthodontic devices that are not in their proper place to avoid gingivitis. The incidence of gingivitis can also be worsened by poor oral hygiene. The routine checkup intensity, however, does not guarantee a person has good oral hygiene. It is to motivate and inform fixed orthodontic users about how to maintain oral hygiene. In every visit, the dentist inform them tips on how to perform proper oral and dental hygiene and how to use oral hygiene tools that may help them prevent gingivitis.^{5,11}

CONCLUSION

A significant relation between control intensity and gingivitis prevalence during the COVID-19 pandemic is proven in this research. Prevention of gingivitis in orthodontic users is done by maintaining the hygiene of the dental and oral cavities. The routine checkup enables patients to meet their dentists regularly. This routine meetings allow the dentists to provide additional information about how to preserve oral hygiene by using appropriate oral hygiene tools of which ultimate goal is to help them prevent gingivitis.

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The Correlation of Parental Knowledge on Oral Health-Related Quality of Life in Down Syndrome Children (Overview in Banjarmasin Special School)

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ABSTRACT

Background: Physical, motor, and intellectual retardation experienced by children with Down syndrome leads to low self-care skills and independence so that Down syndrome children depend on their parents in an effort to maintain oral hygiene. Parental knowledge will be one of the predisposing factors that shape the behavior of parents in maintaining children's oral health. Children's oral health can affect functional, psychological, and social aspects that impact the quality of life related to oral health. **Objective:** To analyze the correlation between the level of parental knowledge about dental and oral health to realize the quality of life in children with Down syndrome at SLB Banjarmasin. **Methods:** This study is an analytical observational study with a cross-sectional approach. The sampling method used was simple random sampling with 32 respondents from parents of children with Down syndrome at SLB Banjarmasin. The level of parental knowledge and quality of life related to oral health was determined using a modified oral health knowledge questionnaire and a modified Parent-Caregiver Perception Questionnaire (P-CPQ). **Results:** The results of the Spearman correlation test showed that there was a significant correlation between the level of parental knowledge and the quality of life of children with Down syndrome associated with oral health in SLB Banjarmasin with a significance value of 0.007 ($p < 0.05$). The correlation coefficient value is 0.466. **Conclusion:** There is a correlation between the level of parental knowledge and the quality of life related to oral health in children with Down syndrome in SLB Banjarmasin City.

Keywords: Down syndrome, Knowledges, Oral health related to quality of life, Parents.

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INTRODUCTION

Parental knowledge and awareness of dental and oral health is a fundamental component in creating a good dental health status in children. The lack of parental knowledge regarding dental and oral health will affect children's attitudes and practices in caring for teeth from an early age. Children will imitate the behavior of parents in maintaining oral hygiene into adulthood.¹ Knowledge becomes one of the predisposing factors that shape the behavior of parents in maintaining children's oral hygiene.² This is especially the case in children with special needs such as Down syndrome, who often have more dental and oral problems than normal children. Research also shows that Down syndrome children have poor oral cavity conditions with a high prevalence rate of caries and periodontal disease.³

Down syndrome is an autosomal chromosome genetic disorder resulting from a trisomy of chromosome 21. According to the World Health Organization (WHO), this disorder occurs in 1 in 1,000 births worldwide. According to the 2018 Basic Health Research (Riskesdas), there was an increase in the incidence of Down syndrome cases in Indonesia by 0.21% from the previous one of 0.13% in 2013 and 0.12% in 2012.^{4,5} Down syndrome has the characteristics of low intellectual function, delays in physical, mental, and motor development. Individuals with Down syndrome have a specific orofacial character that can increase the risk of impaired oral health development and indirectly affect the quality of life.³

Oral Health Related Quality of Life (OHRQoL) is related to a person's sense of comfort with the state of their oral cavity functionally, emotionally, and socially.⁶ Neglected dental and oral problems can cause pain and complaints that will interfere with mastication function, play activities, nutrition, to sleep and concentration disorders. The physical and intellectual retardation experienced by Down syndrome leads to low self-care skills and

independence so that Down syndrome children depend on their parents in an effort to maintain oral hygiene.⁷

Studies on the relationship of parental knowledge to oral health related quality of life in children with Down syndrome have not been studied. This refers to Law No. 18 of 2016, that persons with disabilities have the same rights and opportunities in obtaining information and health services, including dental and oral health. In addition, it is also based on the Long-Term Development Plan for the Health sector (Rencana Pembangunan Jangka Panjang/RPJPK) 2005-2025, which aims to increase awareness, willingness, and ability to live a healthy life for everyone so that the highest increase in the degree of public health can be realized.⁸ Based on this description, the authors are interested in conducting research on "The Correlation of Parental Knowledge to Oral Health Related to Quality of Life" in children with Down syndrome.

MATERIALS AND METHODS

This study used an analytical observational method with a cross-sectional approach that has been declared ethically feasible by the Health Research Ethics Commission of the Faculty of Dentistry, Lambung Mangkurat University with No. 018/KEPKG-FKGULM/EC/III/2022. The population in this study were parents of Down syndrome children from SLB Negeri 2 Banjarmasin, SLB Negeri 3 Banjarmasin, SLB Negeri Pelambuan Banjarmasin, SLB Madana Dun Ya Banjarmasin, SLB Harapan Bunda Banjarmasin, and SLB Paramita Graha Banjarmasin. The sample technique in this study used simple random sampling with a total sample of 32 people. The study was conducted in January – May 2022.

Data were collected directly from the parents of children with Down syndrome. Parental knowledge was measured using a modified questionnaire on parental knowledge about dental and oral health with a choice of



correct (score 1) or incorrect (score 0) answers. The scores are summed up and categorized into high knowledge ($\geq 76\%$), moderate knowledge (56-75%), and low knowledge ($\leq 55\%$).⁹

Oral Health Related Quality of life in children with Down syndrome was measured using a modified Parental-Caregiver Perceptions Questionnaire (P-CPQ) with answers using the Likert scale (never = 0, rarely (1-2x in 3 months) = 1, sometimes ($>2x$ in 3 months) = 2, often (almost every week) = 3, and very often (almost every day) = 4). The scores are summed up and categorized into good quality of life ($\leq 33\%$), moderate quality of life (34-66%), and poor quality of life ($\geq 67\%$). Then to determine whether there is a complaint or not, then out of 5 answer choices are categorized in two groups, if the answer is 'never' = 0 (no impact) and the answers 'rarely', 'sometimes', 'often', and 'very often' = 1 (an impact).¹⁰

RESULTS

This study was conducted on 32 parents of children with Down syndrome in SLB Banjarmasin consist of 17 girls and 15 boys with an age range of 6-20 years old. The majority of parents aged 31-40 years with the last level of education being Senior High School.

Based on Figure 1, it shows that the majority of parents' knowledge about dental and oral health is in the moderate category of 17 people (53.1%) and at least 6 people's knowledge of the low category (18.8%). Based on Figure 2, it shows that the majority of quality of life related to oral health for children with Down syndrome in SLB Banjarmasin City is in the moderate category as many as 17 people (53.1%) and the least is the quality of life related to poor oral health as many as 3 people (9.4%).

Based on Figure 3, it shows that in low-knowledge parents there are children with a low oral health-related to quality of life (1; 3.1%) to moderate (5; 15.6%) and no children with a good oral health-related to quality of life (0; 0%). Most knowledgeable parents are having children with

moderate oral health-related to quality of life (9; 28,1%), good (6; 18,5%) and poor (2; 6,3%). Parents with high knowledge had moderate (3; 9.4%) to good (6; 18.5%) quality children and no children with poor oral health-related quality of life (0; 0%) were found.

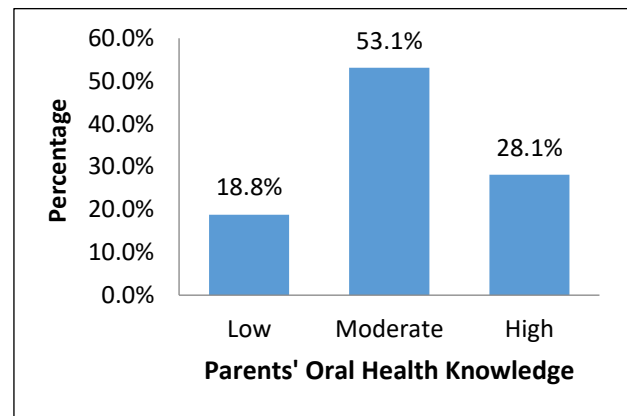


Figure 1. Parents' Oral Health Knowledge

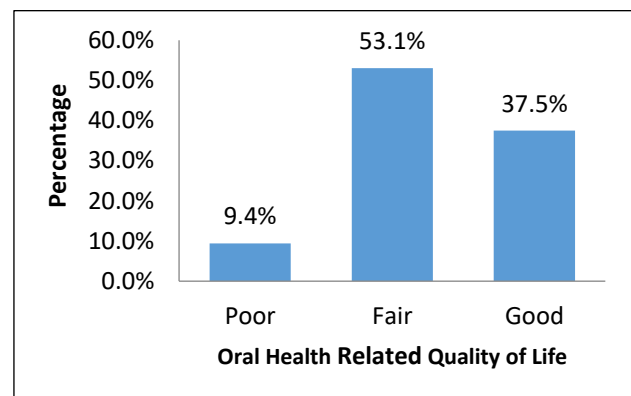


Figure 2. Oral Health Related Quality of Life

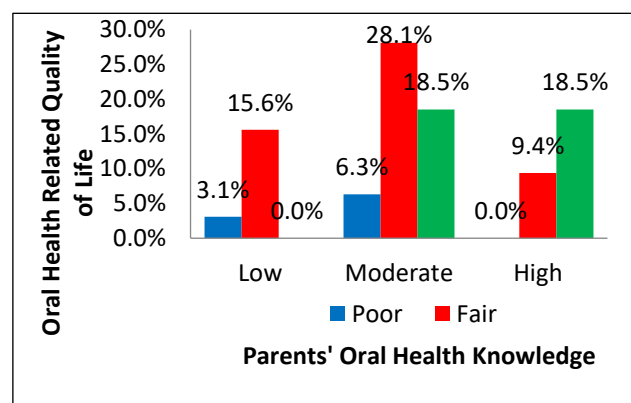


Figure 3. Cross distribution of parents' oral health knowledge on the oral health related quality of life with Down syndrome in SLB Banjarmasin

Table 1. Data Analysis using Spearman Correlation Test

			Oral Health Related Quality of Life
Spearman's rho	Parents' Oral Health Knowledge	Correlation Coefficient Sig. (2-tailed) N	.466** .007 32

**Correlation is significant at the 0.01 level (2-tailed)

Based on Table 1 of Spearman's analysis, a significance value of 0.007 ($P < 0.05$) can be interpreted to mean that there is a correlation between parental knowledge about dental and oral health related to the quality of life in children with Down syndrome in SLB Banjarmasin. The relationship between the two variables is moderate with a correlation coefficient value of 0.466 and a positive value, so it has an unidirectional relationship. The higher parents knowledge about dental and oral health, the better of oral health related quality of life children with Down Syndrome.

DISCUSSION

Oral health is an essential integral part of general health. Poor oral health can have far-reaching consequences for overall wellness. The diseases in children can cause 1) infection, 2) disruption of daily activities, 3) the onset of pain, and 4) growth and development disturbances. According to FDI (Fédération Dentaire Internationale) World Dental Federation, problems that commonly occur are tooth decay, gingival disease, and cancer.¹¹

Knowledge is the foundation of parental behavior that will affect children's knowledge, attitudes, and behavior. Parents with low knowledge of oral hygiene are a predisposing factor to behavior that do not support dental and oral health in children and cause dental and oral health problems, such as caries.^{2,12} Poor oral conditions will interfere with the function and

activity of the oral cavity so that it can affect nutritional status and have an impact on the quality of life of children. Parents need to know the specifics of the dental and oral conditions of children with Down syndrome and know how to maintain daily oral and dental hygiene. This is done in an effort to prevent dental and oral problems in children with Down syndrome and improve the quality of life related to oral health.^{7,12}

Parental knowledge can be influenced by age and education factors. Age is one of the factors that determine a person's thinking maturity in maintaining dental and oral health. The age of 31-40 years is a productive and mature age in carrying out their role as parents. As we get older, the more one's thinking maturity, comprehension, and mindset will increase, so that the knowledge gained will improved.¹³ Education also affects parents' knowledge about dental and oral health. Through the educational process, a person will gain higher knowledge, understanding, expertise, and insight, so that the higher a person's education, the more knowledge he acquired.¹² This is in line with the results of this study which found that parental knowledge about dental and oral health in the "moderate" category is most commonly found in parents with Senior High School education. Parental education factors can influence attitudes in determining the dental health status of children, because as parents need to teach their children how to care for and brush their teeth properly and regularly take their children to the dentist to check their dental health status.¹⁴

According to the results of the questionnaire, the majority of parents incorrect statements about the importance of treating caries in deciduous teeth and the ideal time for a visit to the dentist. The lack of knowledge about dental caries causes parents' awareness to be low to treat caries in deciduous teeth. This is because parents think that deciduous teeth are only temporary and will be replaced by permanent teeth, so damage to deciduous teeth

is considered not a problem. This is accompanied by low parental knowledge about dental health check-up every 6 months to the dentist. According to Utami (2018), this can be due to the experience of parents in taking care of their teeth and mouth just by brushing their teeth without regularly checking to the dentist. The existence of parents' habit to consider that caries is not a disease but rather just a matter of course and does not require further treatment shows that children's dental health problems have not been a major priority. This is due to the lack of socialization, media, and understanding of the importance of maintaining dental and oral health which will affect the growth and development and children's quality of life.¹⁵

Assessment of the quality of life related to oral health in children with Down syndrome based on parental perception is related to how much the child's quality of life decreased quality of life and normal children's activities as a result of dental health. Poor oral and dental health, such as periodontal disease, dental caries, gingivitis, and xerostomia have a significant influence on quality of life. The assessment of oral health related quality of life involves four aspects, such as oral cavity complaints, functional disorders, emotional disorders, and social disorders.⁶

Based on the results of the questionnaire, it was obtained that in the aspect of oral cavity complaints, children with Down syndrome often experience food stuck in their teeth. This result is in line with Ulfah (2019), which states that children with disabilities such as Down syndrome often experience pain and food that gets stuck due to caries. This can be caused by poor oral and dental hygiene as well as the lack of skills of children with Down syndrome in brushing their teeth so that brushing activities become less effective and still leaves an accumulation of plaque and debris on the teeth.⁶ In the aspect of functional limitations, parents report that children with Down syndrome have a long meal time. The impact of caries can cause children with Down syndrome to have difficulty

chewing food into a bolus, thus extending the duration of eating. This functional limitation can also be caused by the lack of coordination of the movements of tongue so that food is often retained in the mouth without being chewed, which ultimately increases susceptibility to dental caries.^{6,16}

In the emotional aspect, dental and oral health problems also affect the feelings of children with Down syndrome by feeling upset/frustrated due to toothache. Children with Down syndrome will show pain behavior by crying, not wanting to talk, stopping laughing, and getting angry as a sign of having a toothache and trying to convey that it affects their mood. This has an impact on the child's psychology and makes him quiet and close to his social environment. These problem will interfere with daily activities such as doing homework, school, disrupting sleep, and limiting eating activities.¹⁷

However, according to Aljameel (2020), parents still find it difficult to recognize the potential impact of the oral health of children with Down syndrome on aspects of their lives.¹⁸ This is based on the results of the study which showed on social aspect, that parents assess that the impact of dental and oral problems still have little impact on the child's situation to smiling/laughing, playing, and going to school. The same results were found in Elfari's (2016) study, which stated that only a few parents reported that their child had refused to play, smiled/laughed because of dental and mouth problems. Nasia's research (2022) also supports that dental and oral health problems do not have much impact on school attendance.^{19,20} This can be influenced by the clinical condition of the teeth, because the more severe the level of tooth decay, the more pain will increase so it will interfere comfort when eating, sleeping, playing, and going to school.¹⁶

This research found that the majority of parents is in the "moderate" category with the oral health related quality of life of children with Down syndrome in the "fair" category (28,1%). Sufficient knowledge of parents still does not

guarantee good dental and oral hygiene if it is not applied or carried out in daily life, as well as low levels of knowledge will affect inappropriate actions in maintaining dental and oral hygiene.²¹ In addition, lack of knowledge about dental caries causes parents' awareness to be low to treat dental caries. According to Rahina (2019), parents believe that dental health care for children is important, but concern for dental care with caries is still low. The dental treatment includes dental fillings, tooth extraction, and examinations to get medication and control.²²

According to Table 1, it can be seen that there is a relationship between parental knowledge about dental and oral health on the oral health related quality of life in children with Down syndrome based on the Spearman correlation test with a significance value of 0.007 and a positive correlation coefficient of 0.466. That is, the higher the level of parental knowledge about dental and oral health, the better the quality of life related to the oral health of children with Down syndrome. These results are in line with the research of Shavazi (2020), that knowledge can affect the quality of life related to oral health through the behavior of maintaining oral health. Someone with high knowledge will have a more positive attitude to practice maintaining oral hygiene which will ultimately improve the quality of life related to better oral health.^{23,24}

According to the theory of H. L. Blum, a person's health status is influenced by behavior. Lawrence Green revealed that the behavior is determined by predisposing factors of knowledge, attitudes, and practices. Knowledge is a very important domain for the formation of practice or action. Parents' knowledge will be the first step in changing children's behavior to maintain oral health, because they act as motivators, educators, and facilitators children's daily oral health.²⁵ On the other hand, low parental knowledge will shape attitudes and behaviors that ignore oral health maintenance which causes oral health problems so that it has

a negative impact on the child's oral health related quality of life.²⁶

The results of this research conducted at the Special School in Banjarmasin City found that parents of children with Down syndrome still received little attention on dental and oral health. This can be seen from the results of the research obtained, although the knowledge of parents is in the moderate category or knows enough about dental and oral health, the majority of children with Down syndrome still feel the impact/influence of dental and oral health problems on their daily lives. The parental knowledge of the "moderate" category is still not able to guarantee good dental and oral health of children with Down syndrome. This is because the knowledge of parents is still at the "know" level, so it has not yet reached the "application" level, namely the level where parents know how to use the material that has been studied in real (actual) conditions. This can also be caused by several factors, including busy parents so it is difficult to accompany children to brush their teeth, there is no time for regular check-ups to the dentist, difficulty controlling children for dental care, economic status, attitude of children who uncooperative, family factors, and social environmental factors. Changing positive attitudes into positive practices also takes time to achieve a quality of life related to good oral health.²⁷

Based on the results of this study, the level of parental knowledge of children with Down syndrome in SLB Banjarmasin City has the majority of knowledge in the moderate category. The majority of oral health related quality of life of children with Down syndrome in SLB Banjarmasin City based on the perception of parents is in the fair category. In this study, there is a correlation between parental knowledge about dental and oral health on the oral health-related quality of life in children with Down syndrome in SLB Banjarmasin City with a moderate positive correlation which means that the higher parental knowledge about oral health,

the better of oral health related quality of life children with Down Syndrome and vice versa.

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The Effect of Adding Propolis to Formula Milk on The *Streptococcus Sobrinus* Inhibition Zone (In Vitro)

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ABSTRACT

Background: Caries is one of the dental and oral health problems that are often suffered by children. One of the main causes is the habit of children consuming formula milk as it contains sucrose. *Streptococcus sobrinus* is an oral pathogenic bacteria that has a role in the initial process of dental caries. One of the natural ingredients that function as anti-caries is propolis. **Objective:** Therefore, this study aims to determine the effect of adding propolis to formula milk on the inhibition zone of *Streptococcus sobrinus* bacteria. **Methods:** This type of research is a Laboratory Experiment with a Post-Test control Group Design. It consists of 4 groups, namely the formula milk group without propolis as a negative control, the formula milk treatment group with propolis concentrations of 5%, 10%, and 20% carried out with 7 replications of each group. The sample is a pure isolate of *Streptococcus sobrinus* bacteria. **Results:** The results showed the average inhibition zone was the formula milk group without propolis was 0.00 ± 0.00 mm, the formula milk group with propolis concentration of 5% was 12.87 ± 1.18 mm, the formula milk group with propolis concentration of 10% was 16.65 ± 1.51 mm, and the formula milk group with propolis concentration of 20% was 24.87 ± 0.39 mm. **Conclusion:** It means the addition of propolis to formula milk has been proven to be effective in inhibiting the growth of *Streptococcus sobrinus* bacteria.

Keywords: Formula milk, Inhibition zone, Propolis, *Streptococcus sobrinus*.

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INTRODUCTION

Caries are one of the most common oral health problems suffered by various social and ethnic groups.¹ The prevalence of pediatric dental caries in Indonesia is still quite high, especially at the age of 3-4 years as much as 81.5% with an average def-t index of 6.2 and age 5-9 years occurs as much as 92.6% with a def-t index of 8.1.² The main microorganism that causes dental caries is mutans streptococci (MS), which are *Streptococcus mutans* and *Streptococcus sobrinus*. Previous studies have shown that the presence of these two cariogenic microorganisms in dental plaque is closely related to the beginning of the process of dental caries formation.³ Based on several epidemiological studies and in vitro studies, *Streptococcus sobrinus* can be more cariogenic than *Streptococcus mutans*.⁴

Milk formula is an industrially produced milk that is used to fulfill the nutritional needs of children. fulfilled. Formula milk has a fairly high nutritional value because most of the essential nutrients are present in formula milk.⁵ Parents' habits in serving formula milk that are not correct can contribute to occurrence of dental caries in children.⁶ The media for giving formula milk using a pacifier bottle until the child falls asleep for a long time can cause the surface of the primary teeth to be exposed to glucose-rich milk so that carbohydrate fermentation occurs and causes demineralization of tooth enamel.⁷

The use of natural materials in dentistry can support dental care programs, especially for the prevention and treatment of caries. One of the natural ingredients that functions as an antibacterial is propolis.⁸ There are differences in the composition of substances contained in propolis depending on where the resin comes from, the climate, the type of bee and the time of collection. The content contained in propolis is resin and bioactive ingredients including flavonoids, tannins, arteplicillins, saponins, phenols and apigenin. The content contained in propolis functions as antibacterial, anti-

inflammatory, antiviral, antioxidant, antifungal, and immunomodulator.⁹

Based on the results of previous research on the effect of propolis extract and propolis candy solution on the growth of *Streptococcus sobrinus*, it was found that propolis with a concentration of 5%, 10% and 20% could inhibit the growth of *Streptococcus sobrinus* bacteria.¹⁰ Effect of probiotic milk combined with propolis has a significant effect on the growth of *Bifidobacterium infantis*.¹¹ There has been no research that combines formula milk with the addition of propolis and its relationship to *Streptococcus sobrinus*. Therefore, the purpose of this study was to determine the effect of propolis addition to formula milk in various concentrations of 5%, 10%, and 20% on the growth inhibition zone of *Streptococcus sobrinus* bacteria.

MATERIALS AND METHODS

This type of research is *Laboratories experimental with Post Test Only Control Group Design*. Seven repetitions were carried out to determine the effect of adding propolis with the Brintish Propolis brand to formula milk with the Nestle Lactogrow 3 brand on the *inhibition* zone of *Streptococcus sobrinus* bacteria (*In vitro*).

Mixing of propolis milk formula was carried out by making propolis concentrations of 5%, 10%, and 20% propolis. Then dissolve 40 grams of formula powder into 400 ml of sterile distilled water heated to a temperature of 73 ° C until boiling. Then cool to room temperature $\pm$ 25°C. From each propolis concentration, namely 5%, 10%, and 20% concentrations. Take 2 ml of propolis solution to be added to 100 ml formula milk. Then put it in different plastic bottles.

Analysis of Results

The data obtained were then analyzed using SPSS to determine the clear zone formed on Petri dishes. The normality of the data was evaluated using the *Shapiro Wilk* test and the

homogeneity of the data was evaluated using the *Levene Statistic test*. If the data obtained is normally distributed and homogeneous, the *One-Way ANOVA* parametric test is carried out with the *Post Hoc* test. If the test results obtained are not normal and not homogeneous, the *Kruskal Wallis* non-parametric test is continued with the *Mann Whitney test*.

RESULT

The smallest inhibition zone average in the formula milk group without propolis is 0.00 ± 0.00 and the largest inhibition zone average in the formula milk + propolis 20% group is 24.87 ± 0.39 . Based on the Shapiro-Wilk test, the data of the formula milk group without propolis cannot be processed because it has a value of 0. The value in the formula milk group without propolis does not meet the assumption of normality so that the data is not normally distributed. While the 5% propolis + formula milk group, 10% propolis + formula milk group, and 20% propolis + formula milk group have a $p > 0.05$ value. So that the data is normally distributed. So it can be concluded that the results of the normality test show that the data are not all normally distributed. The formula milk group without propolis cannot be processed in the homogeneity test because it has a value of 0. In the 5% propolis + formula milk group, 10% propolis + formula milk group, and 20% propolis + formula milk group, the Sig. value is 0.001 so it is concluded that the variance of the data of the 5% propolis + formula milk group, 10% propolis + formula milk group, and 20% propolis + formula milk group is not homogeneous. Thus, the requirements for parametric tests using *One-Way ANOVA* are not met because the data are not normal and not homogeneous, as an alternative, the *Kruskal Wallis* non-parametric test is used to determine the significant effect of adding propolis to formula milk on the inhibition zone of *Streptococcus sobrinus* bacteria (*In vitro*).

Table 1. *Kruskal Wallis Statistical Result*

Value result sign	Standard sign	Description
0.000	< 0.05	There is a difference

The results of the *Kruskal Wallis* statistical test showed a p value of 0.000 which is < 0.05 , which means that there is a significant difference in influence between the formula milk group without propolis, formula milk + 5% propolis group, formula milk + 10% propolis group, and formula milk + 20% propolis group on the inhibition zone of *Streptococcus sobrinus* bacteria (*In vitro*). Data were tested with the *Mann Whitney* test to determine which groups were different.



Figure 1. Diameter of inhibition zone formed from the addition of propolis to infant formula

Table 2. *Mann Whitney Test Result*

Group		Total N	P-value
Milk formula without propolis		14	0.001
Milk formula + 5% propolis			
Milk	formula without propolis	14	0.001
Formula milk + 10% propolis			
Milk	formula without propolis	14	0.001
Formula milk + 20% propolis			
Milk formula + 5% propolis		14	0.002
Formula milk + 10% propolis			
Milk formula + 5% propolis		14	0.002
Formula milk + 20% propolis			
Formula milk + 10% propolis		14	0.002
Formula milk + 20% propolis			

Mann Whitney test results obtained p value <0.05 which shows the comparison of the average diameter of the inhibition zone between each group shows a significant difference (significant).

DISCUSSION

The clear area formed on the Petri dish indicates the diameter of the inhibition zone. The higher the concentration of propolis in formula milk, the greater the content of active substances in it so that the clear area formed is greater, which indicates that the inhibition zone formed is also greater. This is evidenced by the increase in the average inhibition zone in *Streptococcus sobrinus* bacteria, namely (12.87, 16.65, and 24.87). The addition of propolis with a concentration of 20% in formula milk has the largest inhibition zone and in formula milk without propolis there is no inhibition zone formed as shown in Figure 1.

The results of this study indicate that the effect of adding propolis to formula milk has an inhibitory effect on *Streptococcus sobrinus* bacteria. The decrease in the growth of *Streptococcus sobrinus* bacteria is due to propolis containing flavonoid chemical compounds. Brazilian propolis shows a high antibacterial effect on the growth of *Streptococcus sobrinus* bacteria. The result of the interaction of DNA and flavonoids results in damage to the permeability of microsomes, bacterial cell walls and lysosomes.¹²

Flavonoids function by inhibiting cell membrane function, inhibiting nucleic acid synthesis, and bacterial energy metabolism.¹³ Inhibition of bacterial cell membrane function results in the formation of complex compounds from flavonoids that will damage the cell membrane of *Streptococcus sobrinus* bacteria and intracellular compounds of *Streptococcus* bacteria.

When inhibiting nucleic acid synthesis, rings A and B of the compounds in this flavonoid play a role in the interclassification process or

hydrogen bonding process, namely the accumulation of nucleobases, resulting in inhibition of the formation of DNA and RNA.¹⁵ Propolis is effective in inhibiting the growth of *Streptococcus sobrinus* during cell division. During cell division, the thin cell surface layer allows flavonoids to easily penetrate the cell wall and damage the cell contents of *Streptococcus sobrinus* bacteria.¹⁰

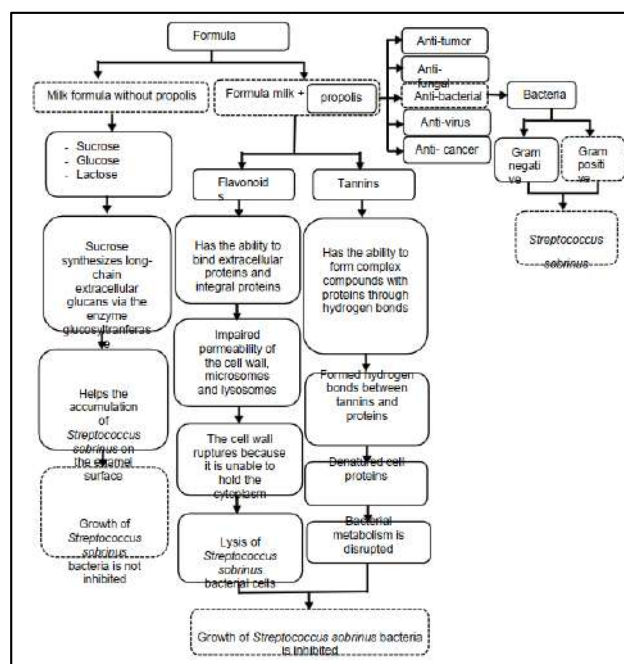


Figure 2. The role of propolis in inhibiting the growth of *Streptococcus sobrinus*

Propolis besides containing flavonoids also contains phenols that inhibit the growth of *Streptococcus sobrinus* bacteria.¹⁴ Phenolic acid inhibits the growth of *Streptococcus sobrinus* bacteria by reducing the surface tension of *Streptococcus* bacteria cells. *sobrinus*. The OH group on phenol is toxic to the original nature of bacterial cells and can damage cells, penetrate the cell wall of *Streptococcus sobrinus* bacteria and denature enzyme proteins in the cytoplasm by forming hydrogen bonds at the active site of the enzyme.¹⁶ This phenol compound can bind to *Streptococcus sobrinus* bacterial proteins. This weak bond between protein-phenol is formed in low concentrations that allow phenol penetration into cells which

change protein properties and inhibit bacterial growth. Whereas in high concentrations phenol can cause protein coagulation and the lysis of *Streptococcus sobrinus* cell membranes. The active substances contained in propolis depend on the compound species and the collection site. Propolis extracts with higher levels of active substances can inhibit bacterial growth more effectively.¹⁰

Propolis also contains antibacterial compounds in the form of tannin. Tannin is one of the polyphenol class antibacterial compounds, soluble in water and organic solvents found in plants that can form protein complexes.⁸ the way tannin works in inhibiting the growth of *Streptococcus sobrinus* bacteria is by lysing the bacteria. This is because tannin targets the wall polypeptides in the bacterial cell wall resulting in less the formation of bacterial cell walls so that bacterial cells will die.¹⁴

CONCLUSIONS

Formula milk with the addition of propolis at a concentration of 20% has the largest inhibition zone against the growth of *Streptococcus sobrinus* bacteria. Therefore it can be used as an alternative to reduce the risk of dental caries in children and formula milk without the addition of propolis does not have an inhibition zone on *Streptococcus sobrinus*.

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The Effect of Bismuth as A Local Hemostatic Material Post Extraction of Permanent Mandibular First Molars Teeth

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ABSTRACT

Background: Bleeding is a post-extraction complication that is often found in dentistry. Normally post-extraction bleeding stops 12-24 hours after surgery, but it is often found for more than 24 hours. The post-extraction bleeding usually stops by pressing the area with sterile gauze but there is an obstacle due of the large volume of blood. **Objective:** to evaluate the bismuth subgallate as an effective local hemostatic agent. **Methods:** This study conducted on patients who came to the Oral Surgery Clinic, Nala Husada Hospital Surabaya, population aged 18-60 years, with permanent mandibular first molars diagnosed with chronic apical periodontitis et causa pulp gangrene or radix gangrene without systemic disorder and planned for extraction teeth with close method. It was divided into 2 groups by simple random sampling group design; the control group and the treatment group. After tooth extraction with the close method, a local hemostatic agent will be applied at the socket. The control group used a paste containing vaseline, while the treatment group used a paste containing bismuth subgallate. This paste contains 2.25% bismuth subgallate mixed with Peruvian balsam. After the application of local hemostatic agents, both the control group and the treatment group will be calculated the bleeding time, bleeding volume, and whether or not the secondary bleeding occurs. **Conclusion:** of this study is that bismuth subgallate has an effect as a local hemostatic agent after extraction of the mandibular first permanent molars.

Keywords: Bismuth subgallate, Bleeding, Local hemostatic agent, Post extraction.

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INTRODUCTION

Bleeding is a post-extraction complication that is often encountered in dentistry.¹ Normally post-extraction bleeding in healthy patients stops after 12-24 hours after surgery, however post-extraction bleeding is often found for more than 24 hours, so the patient has to come back to the dentist or to the emergency department because they are disturbed by the blood that keeps coming out of the socket.^{1,2}

Doctors usually stop the post-extraction bleeding by pressing the post-extraction area with sterile gauze (*digital pressure*), either moistened with a local hemostatic agent such as epinephrine or tranexamic acid, or without any local hemostatic material covering.^{2,3} In addition, bleeding can be stopped by administering local hemostatic materials such as *surgicel* into the socket, suturing or a wounds that cannot be sutured can be covered with dressing materials such as *periodontal packs*.³ Administration of local hemostatic agents often cannot stop bleeding immediately because of the large volume of blood that comes out of the socket. Therefore researchers want to find a new local hemostatic agent that is effective and efficient to stop post-extraction bleeding.

Bismuth subgallate is a one of local hemostatic agent that has been used by several experts to stop bleeding in the palate,⁴ in the tails of Wistar rats, both induced with Clopidogrel and not⁵ and in the anterior tooth sockets that had previously been sutured.⁶ However, this material has not been studied to stop posterior tooth socket bleeding.

Arroyo Júnior et al. discovered that bismuth subgallate has an effect on factor 12 activation, which accelerates the intrinsic pathway in the coagulation cascade, contributing to the hemostatic characteristic of this compound. The authors also considered the possibility that bismuth subgallate might inhibit fibrinolysis and, consequently, increase fibrosis.⁷ The researcher wanted to know the

effect of *bismuth subgallate* as a local hemostatic agent after the extraction of the mandibular first permanent molars.

MATERIALS AND METHODS

This study is a simple randomized sampling group design with a *double-blind post test only control group design* that has been declared ethically feasible by the Health Research Ethics Commission, Rumah Sakit Gigi dan Mulut Pendidikan Nala Husada, Universitas Hang Tuah with No. EC/049/KEPK.RSGMNH/IX/2023. The sample was patients who came to the Oral Surgery Clinic, Nala Husada Hospital Surabaya, aged 18-60 years old, with permanent mandibular first molars diagnosed with chronic apical periodontitis et causa pulpal gangrene or radix gangrene without systemic disorder and planned for tooth extraction *close method*. The number of research subjects was obtained from the minimum sample size formula for unpaired numerical comparative research of two groups once measured by Slovin, namely:

$$n = \frac{N}{1 + N(e)^2}$$

Based on the results of the sample calculation, the minimum sample size is 11 patients per group or 22 patients for 2 groups. The samples were divided into 2 groups, namely the control group and the treatment group. After extraction of the mandibular first molars with *the close method*, a local hemostatic agent will be applied to the socket. *The close method* of extraction is a tooth extraction technique without opening the flap and reducing the bone, so that no suturing is needed in the socket.

The control group used a paste containing vaseline, while the treatment group used a paste containing *bismuth subgallate*. This paste contains 2.25% *bismuth subgallate* mixed with Peruvian balsam. Both the patient and the operator did not know about the type of drug that would be administered after the

extraction. After administration of local hemostatic agents, both the control group and the treatment group calculated for bleeding time, bleeding volume, and whether or not secondary bleeding is present.

Bleeding time was the time that calculated from the time of the local hemostatic agent has been applied until the blood stops coming out of the socket calculated with a stopwatch in seconds. Bleeding volume was the difference in the weight of the cotton roll before and after it is used to absorb blood that comes out of the socket. Weight was measured on a digital gold scale in milligrams. Secondary bleeding was blood that comes out of the socket after a blood clot has formed. Secondary bleeding was positive if blood comes out again from the socket after 30 minutes the patient bit the tampon, it was known from the tampon which is stained with blood.

The data was collected and analyzed. The data scale used in this study is the ratio with 2 sample groups and unpaired. Normality test using Shapiro-Wilk and homogeneity test using Levene Test. Data analysis used Mann Whitney with $p < 0.05$ to determine the effectiveness of bismuth subgallate as a local hemostatic agent after the extraction of the mandibular first permanent molars. The research flow diagram was shown below:

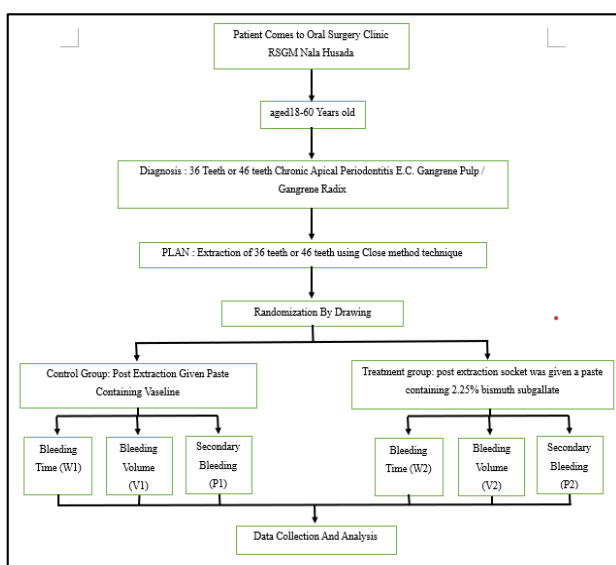


Figure 1. The research flow diagram

RESULTS

Table 1 showed the results of bleeding volume and bleeding time after administration of local hemostatic agents to the post-extraction tooth socket. Based on table 2, the results of the normality test with the Shapiro-Wilk showed that the blood volume of the control group, the blood volume of the treatment group, the bleeding time of the control group and the bleeding time of the treatment group had a p-value greater than 0.05 ($p \geq 0.05$) indicating that normally distributed data. Based on table 3 the results of the homogeneity test with the Levene test showed that blood volume and bleeding time had a p-value less than 0.05 ($p \leq 0.05$) indicating that the data were not homogeneous so the hypothesis test uses the non-parametric Mann-Whitney test.

Table 1. The mean value and standard deviation of blood volume and bleeding time

	Average	Standard deviation
Blood volume(ml)	1.73	1.46
Bleeding time (seconds)	70, 81	20.04

Table 2. Results of the normality test with Shapiro-Wilk

	Group	Shapiro-Wilk Sig.
Blood volume (ml)	Control	0.232
	Treatment	0.385
Bleeding time (seconds)	Control	0.895
	Treatment	0.377

Table 3. Homogeneity test results

	Sig.
Blood volume(ml)	0.013
Bleeding time (seconds)	0.028

Table 4. Mann-Whitney Hypothesis Test

	Sig.
Mann-Whitney	0.00*

From the results of the Mann-Whitney test, if the p value <0.05 , there was a significant difference in each group. Based on Table 3, a significant value of 0.00 is obtained, which means that there was a significant difference in each treatment group. Then a post hoc test was carried out to find out significant differences between groups.

DISCUSSION

Bismuth subgallate has been used for some time as an ingredient to stop bleeding in adenotonsillectomy surgery.⁴ Bismuth subgallate is an insoluble material in the oral cavity. In this study, the results showed a significant difference between post-extraction M1 tooth sockets that were given bismuth subgallate, which experienced a faster bleeding time than the control group. Formed within them are chemical compounds, growth factors, and inflammatory mediators (cytokines) that contribute to the processes of re-epithelialization and wound contraction. Saliva contains plasminogen activator, while the movements in the mouth, including chewing and speaking, trigger an extension of the bleeding time.⁸

The first molar with a sufficiently large dimension is felt to be capable of presenting a wider socket compared to the dimensions of the other tooth elements.⁹ However, according to research data, no effect was found from these conditions. The application of bismuth subgallate was able to help the formation of blood clots faster than the control.

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The Effect Of Black Cumin Nanoemulgel (Nigella sativa) On Fibroblasts In Post-Tooth Extraction Wound Healing In Mice

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ABSTRACT

Background: Tooth extraction is said to be successful when accompanied by a good wound healing process. Innovation for post-tooth extraction wound treatment is necessary. Black cumin has active ingredients that function as anti-inflammatories. The formulation used is nanoemulgel because it has the advantages of stability and good adhesion. **Objective:** To evaluate the effect of black cumin nanoemulgel on the number of fibroblasts in the wound healing process after tooth extraction in rats. **Methods:** This study was conducted using post-test only control group design with a total sample of 22 samples divided into 4 groups with each group totaling 5 samples and 2 samples as a drop out. The application is carried out as much as 3 times a day for 5 days. Tissue collection from experimental animals was carried out and then histology preparations were made. Calculations of fibroblast were carried out using hematoxylin eosin (HE) staining and carried out in the apical 1/3 of the 3 visual fields with a V pattern. Statistical tests used are the One-Way Anova test and the Post Hoc LSD test. **Results:** There was significant difference in the number of fibroblasts between groups ($p = 0.000$). Black cumin nanoemulgel concentration of 15% showed highest number of fibroblasts. **Conclusion:** Nanoemulgel black cumin (Nigella sativa) 15% can increase the number of fibroblasts in wound healing post tooth extraction in rats. Nanoemulgel black cumin (Nigella sativa) 15% have the potential to accelerate wound healing process by increasing the number of fibroblasts.

Keywords: Black Cumin, Number of Fibroblasts, Post-Tooth Extraction, Wound Healing

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INTRODUCTION

Tooth extraction, also known as tooth extraction in dentistry, is a dental procedure that removes a tooth from its socket.¹ Tooth extraction causes minimal trauma to the supporting tissue and bone surrounding it.²

A tooth extraction is considered successful if an adequate wound-healing process follows. Dentists must be attentive to the wound-healing process because it can cause pain and discomfort in the patient's oral cavity.² The prolonged healing time of a wound after tooth extraction can result in pain, bleeding, swelling, impaired chewing and speech function, and even infection.³

The wound healing process consists of four stages: hemostasis, inflammation, proliferation, and remodelling.⁴ The proliferation phase begins approximately on the fourth day after the injury and lasts until the 21st day. Fibroblasts migrate with the help of platelet-derived growth factor.⁵ In wound healing, there are several growth factor that can regenerate tissue, one of which is fibroblast growth factor (FGF) that can stimulate proliferation and deposition of fibroblast.⁶

Gengigel is one of the medications available that can be used to quicken the healing of socket wounds following tooth extraction.⁷ Gengigel contains hyaluronic acid, which has anti-inflammatory, antimicrobial, and antioxidant properties that aid in wound healing.⁸

An inventive use of herbal plants to treat wounds following tooth extraction must be considered. In comparison to drugs made from synthetic chemicals, herbal plants are less expensive and have fewer side effects. This is because herbal plants have been shown to cure diseases, and their use is more effective, efficient, safe, and economical.⁹ Black cumin is one example of a herbal plant that can be used.¹⁰

Black cumin (*Nigella sativa*) contains saponins that aid in wound healing (angiogenesis) through Vascular Endothelial

Growth Factor (VEGF). Black cumin (*Nigella sativa*) contains the mineral zinc, which is known to aid in wound healing. This zinc aids in fibroblast proliferation and collagen synthesis.¹¹ Black cumin (*Nigella sativa*) also contains flavonoid compounds that can increase the expression of the Insulin-Like Growth Factor (IGF-1) receptor as a mediator of fibroblast proliferation and collagen synthesis.¹² Flavonoid can increase immunity and reduce inflammation, so flavonoid can stimulate fibroblast growth factor (FGF) that can increase the number of fibroblast.¹³

A type of emulsion with droplet sizes ranging from 1 to 100 nm that is immersed in a gel base is called nanoemulgel, and this formulation will be used in this study.¹⁴ Nanoemulgel formulations have the advantage of good stability and adhesion, providing good delivery of drugs and active substances with low solubility, assisting in drug release control, and extending drug effects.¹⁵ The small droplet size also facilitates nanoemulgel penetration into the skin and mucosa.¹⁶ In addition, nanoemulgel has a lower viscosity than hydrogel preparations, which results in better distribution. This nanoemulgel has the physical characteristics of a semisolid formulation that is thick, has a soft texture, and is easily spread on the skin or mucosa.¹⁷

Previous research by Wulandari et al¹⁸ found that a 10% gel concentration of black cumin (*Nigella sativa*) extract increased the number of fibroblast cells on the eighth day after application to gingival wounds. Another study by Septiana. L¹⁹ found that black cumin oil (*Nigella sativa*) emulgel increased the number of fibroblasts in ulcerative wounds.

This study was evaluated the effect of black cumin nanoemulgel (*Nigella sativa*) on the number of fibroblasts in healing wounds after tooth extraction in rats.

MATERIALS AND METHODS

This research used a post-test group control design with black cumin (*Nigella sativa*) extract nanoemulgel concentrations at 10% and 15%, gengigel, and distilled water. 1 gram of black cumin nanoemulsion is diluted with 9 ml of gel base to make 10% black cumin nanoemulgel, and an 1,5 grams of black cumin nanoemulsion is diluted with 8,5 ml gel base to make 15% black cumin nanoemulgel. Tooth extraction was conducted on the lower left incisor teeth of male Wistar rats under ketamine-xylazine anaesthesia, using a 1 mL syringe with a short needle measuring 26Gx1/2 inch. Ketamine-xylazine solution was chosen because it provides a short onset of action. Anesthesia is administered intraperitoneally in the left or right lower quadrant of the abdomen with an injection angle of 30-45 degrees. Tooth extraction is performed with an artery clamp and careful luxation movements to prevent the tooth from fracture. Following tooth extraction, the socket is irrigated with distilled water to remove debris or tooth extraction remnants.⁷

In this research, fibroblasts were extracted from male Wistar rats' tooth sockets after tooth extraction. Hematoxylin and eosin staining for fibroblasts. Calculations were performed at 400x magnification in the apical third of the three fields of view with a V pattern, particularly on the left, middle, and right. One Way Anova Test was used as a statistical test.

RESULT

Fibroblasts were observed under a microscope at 400x magnification in three fields of view (shown in Figure 1.). The average number of fibroblasts obtained in the study is shown in Table 1 below :

Table 1. The Average Number of Fibroblast

Treatment Group	N	Mean	Standard Deviation
10% Treatment Group	5	10,9	0,8
5% Treatment Group	5	27,4	1,8
Positive Control Group	5	47,5	2,1
Negative Control Group	5	7,4	1,3

According to Table 1, the negative control group has the lowest number of fibroblasts. The highest number of fibroblasts was found in the positive control group. The black cumin nanoemulgel treatment group at 15% concentration had more fibroblasts than the black cumin nanoemulgel treatment group at 10% concentration.

The histological picture below shows the results of administering black cumin nanoemulgel at 10% and 15% concentrations, positive control, and negative control.

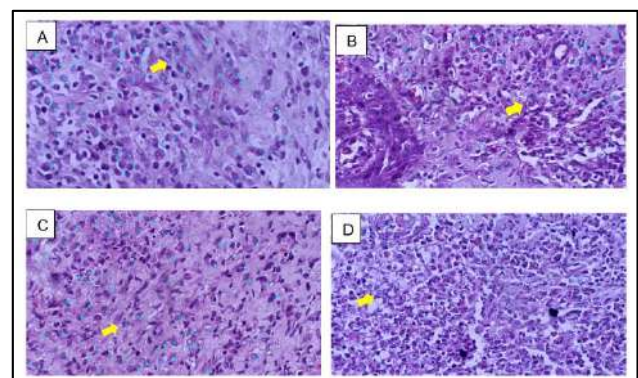


Figure 1. Histological images of the number of fibroblast after tooth extraction. 15% black cumin nanoemulgel treatment control group (A), 10% black cumin nanoemulgel treatment control group (B), Negative control group (aquades) (C), Positive control group (gengigel) (D).

Annotation:

-  : Fibroblast cells with oval or elongated nuclei and spindle shape (contrast).
-  : Fibroblast cells with oval or elongated nuclei and spindle shape.

Table 2. The Result of the Normality Test (Shapiro-Wilk)

Treatment Group	Sig. (P)	Annotation
10% Treatment Group	0,09	Data is Normally Distributed
15% Treatment Group	0,09	Data is Normally Distributed
Positive Control Group	0,29	Data is Normally Distributed
Negative Control Group	0,54	Data is Normally Distributed

Table 2 shows the result of the normality test which demonstrates that each of the treatment group has a p-value greater than 0,05, indicating that each data is normally distributed.

Table 3. The Result of the Homogeneity Test (Levene's Test)

Levene's Test	Sig.	Annotation
	0,220	Data Variance is Homogenous

Table 3 shows the homogeneity test results. The homogeneity test results revealed $p > 0,05$ ($p=0,220$), indicating that the research findings data were homogeneous. Because the data was homogeneous and all groups were normally distributed, hypothesis testing was performed using the One-Way ANOVA parametric test.

Table 4. The Result of One-Way ANOVA Test (Comparative Test in One Group)

Treatment Group	Sig. (P)	Sig. 0,05	Annotation
10% Treatment Group			
15% Treatment Group			
Positive Control Group	0,000	$p < 0,05$	Significantly different
Negative Control Group			

Table 4 shows the results of the One-Way ANOVA test, indicating there is a significant difference in the number of fibroblasts between the research groups with a p-value < 0.05 ($p=0.000$). A Post Hoc LSD test was then performed to determine the differences between the two groups.

Table 5. The Result of Post Hoc LSD Test (Comparative Test between 2 Groups)

Treatment Group	10% Concentration	15% Concentration	Positive Control	Negative Control
10% Concentration		0,000	0,000	0,003
15% Concentration			0,000	0,000
Positive Control				0,000
Negative Control				

Table 5 shows the results of the post hoc LSD test. The test results between treatment groups on the expression value of the number of fibroblasts revealed there was a significant difference in the number of fibroblasts ($p < 0,05$) between groups.

DISCUSSION

According to this research, administering black cumin (*Nigella sativa*) nanoemulgel could affect the number of fibroblasts in post-tooth extraction wounds. The data analysis results in Table 1 shows that the positive control group had the most fibroblasts, and the 15% black cumin (*Nigella sativa*) nanoemulgel treatment group had more fibroblasts than the 10% black cumin (*Nigella sativa*) nanoemulgel treatment group.

Following tooth extraction, a wound-healing process needs to occur. The wound healing process can be accelerated by using a topical medication available in the market, such as gengigel, which contains 0.2% hyaluronic acid. In the early stages of wound healing,

hyaluronic acid forms a temporary structure in the wound tissue that aids in the diffusion of nutrients and cells while also acting as an anti-inflammatory. The hyaluronic acid content of gengigel has been shown to promote fibroblast cell proliferation and hasten wound healing after tooth extraction.⁷

The findings of this study are consistent with previous research by Mastuti et al¹¹ who concluded that black cumin (*Nigella sativa*) ointment could increase the number of fibroblasts in incision wounds in mice. Wulandari et al¹⁸ discovered that a gel formulation containing 10% black cumin extract could increase the number of fibroblasts applied to gingival wounds. According to Septiana. L¹⁹ using black cumin oil nanoemulgel preparations on ulcerative wounds increased the number of fibroblasts. Previous research by Mastuti et al¹¹ demonstrated that the use of 40% and 60% black cumin extract ointment could increase the number of fibroblasts in mouse wounds, with the number of fibroblasts being higher in the 40% black cumin extract ointment treatment group on day 7 because the wound-healing process takes less time and many fibroblasts have been converted into fibrocytes and then into collagen.

Black cumin nanoemulgel (*Nigella sativa*) contains saponins, flavonoids, and thymoquinone, which can increase the number of fibroblasts. The saponin compound found in black cumin aids wound healing by producing Vascular Endothelial Growth Factor (VEGF). The flavonoid content of black cumin is known to increase the amount of collagen and stimulate macrophage activity to trigger the epithelialization process, increase the production of extracellular matrix, growth factors, cytokines, and angiogenesis through the release of growth factors such as Keratinocyte Growth Factor (KGF).²⁰

Thymoquinone, another component of black cumin (*Nigella sativa*), can activate B and T lymphocytes. T lymphocytes will promote the development of cytotoxic and helper T cells, which will phagocytose inflammatory cells and

hasten the healing of wounds, particularly during the inflammatory stage.²¹

The form of the nanoemulgel, which is an emulgel prep in the form of nanoparticles made with a nanotechnology system and small particles²², can also have advantageous effects. The smaller the particle size, the easier it is for the substance to penetrate the skin.¹⁴

The LSD post hoc test results revealed that there were significant differences between the negative control group, the positive control group, and the black cumin (*Nigella sativa*) nanoemulgel treatment group at 10% and 15% concentrations. This research found that black cumin nanoemulgel (*Nigella sativa*) has an effect on the number of fibroblasts in post-tooth extraction wounds. This is proven by a significant difference in the number of fibroblasts in wound healing after tooth extraction between the 10% and 15% black cumin (*Nigella sativa*) nanoemulgel treatment groups versus the negative control group. The positive control group obtained the highest fibroblast results in this study because the amount of gengigel given to each treatment was 0.1 ml, so the active ingredient content of the gengigel was greater than that of the black cumin nanoemulgel, which was administered at 0.02 ml for each treatment.

This study concluded that Black cumin nanoemulgel (*Nigella sativa*) concentration of 15% could increase the number of fibroblasts in wound-healing process following tooth extraction in mice. Black cumin nanoemulgel concentration 15% have the potential to accelerate wound healing process by increasing the number of fibroblasts.

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The Effectiveness of The Blended Learning Method as A Learning Innovation During The Covid-19 Pandemic at Faculty Of Dentistry, Hang Tuah University Surabaya

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ABSTRACT

Background: The covid-19 pandemic has an impact on many sectors include the education sector. Dental education students are not only given academic knowledge but also need to be trained for their dental practice skills. Various obstacles during covid-19 pandemic require educational institutions to make innovations to maintain the quality of graduates. One of the innovations that can be implemented is blended learning. Blended learning combines online methods for lecture substitution and face-to-face methods for clinical activities on phantoms. The indicator of success of this method is by getting pass in the National Competency Exam for Dentist (UKMP2DG). **Objective:** To determine the effectiveness of the blended learning method as a learning innovation during the covid 19 pandemic at the Faculty of Dentistry, Hang Tuah University Surabaya. **Methods:** This is an observational analytic study by comparing the percentage of UKMP2DG's passing rates during the period before the covid 19 pandemic (2019) and during the implementation of the blended learning method (2021 and 2022). Data analysed using one-way Anova with an error of 5%. **Results:** The results of oneway Anova showed p value = $0.120 > 0.05$. **Conclusion:** There is no significant difference between the number of UKMP2DG passing rates from 2019, 2021 and 2022 means blended learning method can provide the same number of pass rate as other previous methods.

Keywords: Blended Learning, Covid 19, Dental Education, Learning Innovation

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INTRODUCTION

At the beginning of 2020 the whole world had to face the spread of a new virus called Corona. The virus that initially attacked in Wuhan, then spread throughout the world including Indonesia. This situation led WHO to established a pandemic condition throughout the world. The covid-19 pandemic has an impact on many sectors include the education sector.¹

The government of Indonesia through Permenkes No.4 & 15year 2020 made a policy for the education sector during pandemic covid 19 that regulates online learning.² Problem arise when not all learning processes can be carried out effectively through online learning. There are many things in learning that cannot be replaced by online learning, such as the need for direct interaction between students and teachers. To overcome this problem requires an innovation during the learning process. Dentistry Faculty of Universitas Hang Tuah applies a blended learning system in the even semester of the 2021/2022 academic year. Blended learning is a formal education program that allows students to learn through mixed online and classical face to face learning^{3,4}. Dentistry Faculty of Hang Tuah University combines online lectures using video conference technology and clinical practice with phantoms using face-to-face methods. The face-to-face method is carried out with due regard to health protocols. Students are divided into several small groups and clinical time is arranged, so that there is not much students gather at the same time. All students who will carry out clinical phase on campus must be declared free of covid 19 by the results of the swab antigen examination which is valid for 1 day. This is done to maintain safety and comfort during the face-to-face clinical process in during covid 19 pandemic.

One of indicator of success in learning process is exam. UKMP2DG is a Competency Test for Dentistry Professional Program Students which is carried out by Kemristek DIKTI every 4 times in a year. Students who are

entitled to become UKMP2DG participants are active students in the dental profession study program and have fulfilled 100% patient requirement and at least 80% non-patient requirement. This exam is an exit exam therefore the results of this exam are an indicator of the success of the education program at the faculty of dentistry.

This study aims to determine the effectiveness of the blended learning method as a learning innovation during the covid 19 pandemic at the UKMP2DG at the Faculty of Dentistry, Hang Tuah University Surabaya.

MATERIALS AND METHOD

This research is a quantitative study with observational analytic research type. The study used secondary data from the UKMP2DG graduation results at the Faculty of Dentistry, Hang Tuah University in 2019, 2021 and 2022. 2019 was the period before the covid19 pandemic while 2021 and 2022 were the period of application of the blended learning method. UKMP2DG in 1 year is held for 4 periods with varying numbers of participants. Each period in each year will be calculated the percentage of graduation to be compared.

Percentage of graduation:

$$= \frac{\text{total graduate}}{\text{total participant}} \times 100\%.$$

Data analysis to determine differences using oneway anova after previously conducting a normality test and homogeneity test.

RESULTS

The normality and homogeneity test show normality and homogeneity in the percentage of graduation's data. The normality test in Table 1 showed that the data has normal distribution ($p > 0,05$), so that it fulfills the requirement for parametric test. The

homogeneity test in Table 2 showed $p > 0,05$, which showed that the data does have a homogeneity variance.

Table 1. Normality Test

	Statistic	df	Sig
Year 2019	0.795	4	0.093
Year 2021	0.864	4	0.273
Year 2022	0.867	4	0.285

Table 2. Homogeneity Test

	Levene statistic	df1	df2	Sig
Based on Mean	0.656	2	9	0.542

The comparative test carried out in this research data is Oneway Anova because there are more than 2 unpaired groups with a normal data distribution and homogeneous data variance. The data is said having a significant difference between the group if the p value showed less than 0,05 ($p < 0,05$). The comparative test of this research data (Table 3) showed $p > 0,05$ so that can be interpreted that there is no significant difference between the number of UKMP2DG passing rates from 2019, 2021 and 2022.

Table 3. One Way ANOVA

Sum of Squares	df	Mean Square	F	Sig.
826.245	2	413.122	2.711	.120
2197.842	11			

Table 4. Post Hoc LSD

	2019	2021	2022
2019	-	0.056	0.386
2021	0.056	-	0.195
2022	0.386	0.195	-

Post-hoc LSD test was conducted to analyze the difference between the number of UKMP2DG passing rates from 2019, 2021 and 2022. The results of the Post-hoc LSD further test show that the significance value of the difference in means between groups is more

than 0.05, so it can be explained that there is no significant difference between the number of UKMP2DG passing rates from 2019, 2021 and 2022, meaning that the blended learning method can provide the same number of pass rates as other previous methods.

DISCUSSION

In this study, we found that the blended learning method could accommodate the needs of fulfilling student competencies. As we know, the condition of the Covid 19 pandemic has caused limitations in conducting face-to-face meetings between lecturers and students. These limitations have been tried to be overcome by online methods, but in the field of dentistry, not all learning materials can be done online.⁹ The blended learning method has many advantages. Research from Bibi (2015) shows that there is an increase in the understanding of students who use blended learning when compared to conventional learning. One of the advantages of the blended learning method is that online learning can be done at a more flexible location and time. In accordance with the results of the interviews, it was found that most respondents, both lecturers and students, were happy with the flexible time and place.

In this study it was also found that according to the lecturer's opinion, the blended learning method can accommodate the needs of fulfilling student competencies at the professional stage. Faculty of Dentistry, Hang Tuah University is an educational institution that produces dentist graduates. Dentists are expected to have competency skills in treating patients. Online learning is completely unsuitable when applied to competencies that require skills. Blended learning can be an alternative during the Covid 19 pandemic where on the one hand it is required to implement health protocols by postponing face-to-face activities but on the other hand it must still produce graduates who have good competence. In the opinion of several lecturers, the blended

learning method cannot be applied easily. In the implementation of effective blended learning, the role of the lecturer is very important. Lecturers must have the ability to use information technology and could convey learning material.

Adequate facilities and infrastructure are needed to support the success of the blended learning method. Faculty of Dentistry, Hang Tuah University based on infrastructure data for 2020-2021 shows that it has prepared sufficient infrastructure to support the blended learning system during the Covid 19 pandemic. Video conferencing using the zoom application is provided for each batch of students which can be used unlimitedly to support learning activities during pandemic covid 19. During the pandemic, the skills of the patient directly could not be carried out optimally so that the Faculty of Dentistry, Hang Tuah University increased the number of phantom models in the practicum room.

One of indicator of success in learning process is exam. UKMP2DG is a Competency Test for Dentistry Professional Program Students which is carried out by Kemristek DIKTI every 4 times in a year. Students who are entitled to become UKMP2DG participants are active students in the dental profession study program and have fulfilled 100% patient requirement and at least 80% non-patient requirement. This exam is an exit exam therefore the results of this exam are an indicator of the success of the education program at the faculty of dentistry. There is no significant difference between the number of UKMP2DG passing rates from 2019, 2021 and 2022 means blended learning method can provide the same number of pass rate as other previous methods.

CONCLUSION

Based on the results it can be concluded that the blended learning method is an effective learning method during the Covid 19 pandemic at Faculty of Dentistry, Hang Tuah University. Blended learning method can provide the same

number of pass rate of UKMP2DG as other previous methods.

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