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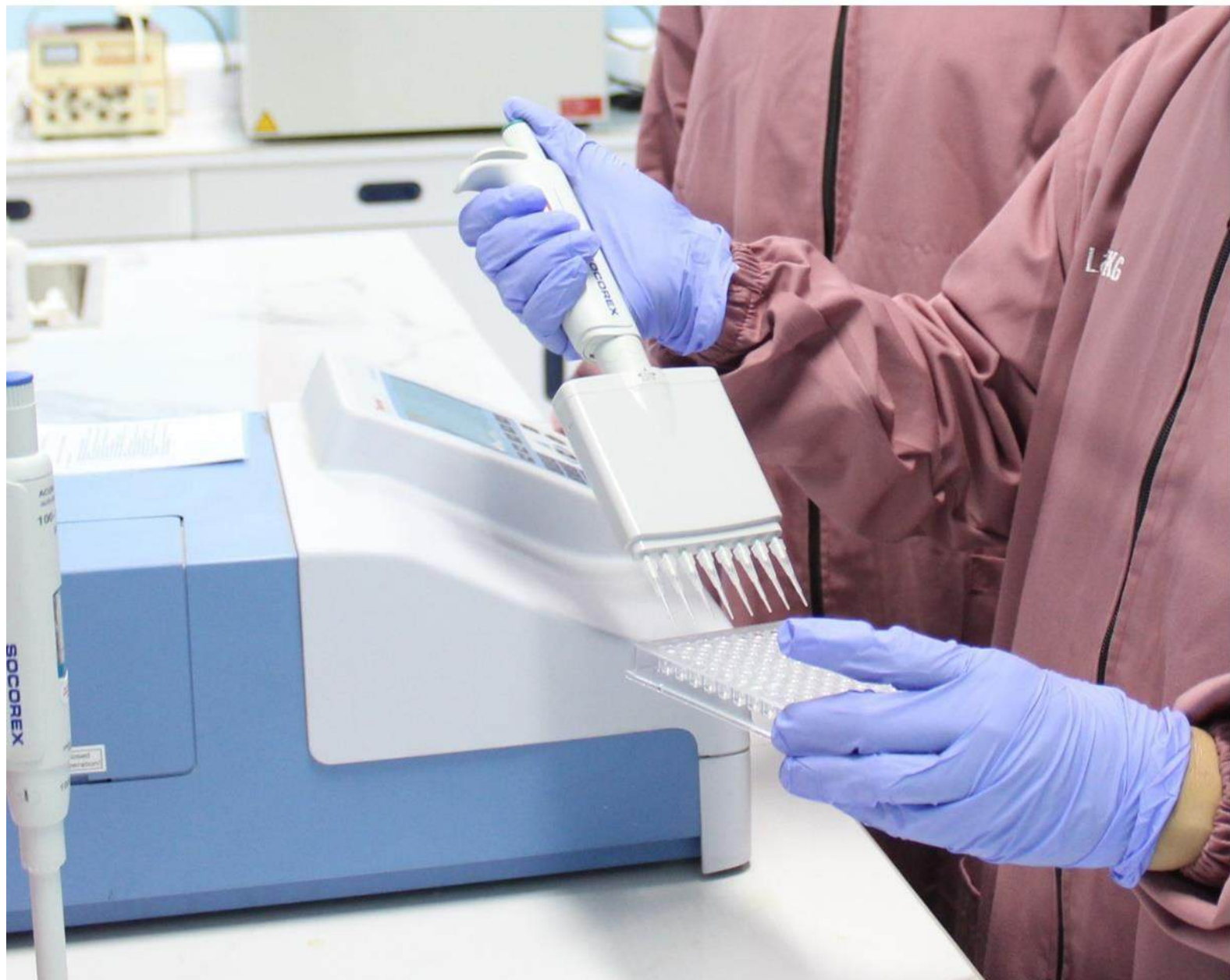
KEDOKTERAN GIGI



P-ISSN: 1907-5987

E-ISSN: 2615-1790

VOLUME 17 NO.2 AGUSTUS 2023



[HTTP://JOURNAL-DENTA.HANGTUAH.AC.ID](http://journal-denta.hangtuh.ac.id)

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Jurnal Kedokteran Gigi diterbitkan setiap bulan Februari dan Agustus oleh
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Children's Knowledge Level About Oral Health Before and After Watching Dental Health Education (DHE) Videos

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Online submission : 06 October 2022

Accept Submission : 08 July 2023

ABSTRACT

Background: The Ministry of Health's Basic Health Research (Riskesdas) in 2018 showed that the largest proportion of dental and oral problem is among the age group of 5-9 years (67.3%) where only 14.6% have received treatment by dental professionals. This is due to a lack of knowledge about maintaining oral health in children, and one of the health efforts to reduce dental and oral problems is to provide Dental Health Education (DHE). Generally, DHE activities are carried out face to face and practiced together in the field. The implementation during the Covid-19 pandemic requires a strategy that considers health and security aspects to prevent the transmission of the virus. **Objectives:** This research aims to determine the difference in children's knowledge level about dental and oral health before and after DHE with educational video media. **Methods:** This is an experimental analytic research with a cross-sectional study design. It was conducted at the Alamy Integrated Islamic Elementary School in Subang, where third-grade students completed the pre-test before watching the educational video, and post-test after watching video. **Results:** The average value of children's dental and oral health knowledge before and after being treated was 40.0 and 42.1, respectively. Furthermore, the Wilcoxon test showed a significant effect on the provision of DHE to children's knowledge about oral health. **Conclusion:** The provision of DHE significantly affects children's knowledge conveyed through educational videos.

Keywords: Children's Knowledge, Dental Health Education (DHE), Educational Video

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INTRODUCTION

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.^{1,2}

The Riskesdas 2018 data showed that 57.6% of Indonesians have dental and oral problems, and only 10.2% received services from dental professional.³ According to the Riskesdas 2018, 67.3% of dental and oral issues occurred between the ages of 5 and 9. Only 14.6% have received treatment by a dental professional due to a lack of knowledge about maintaining oral health in children. Furthermore, 92.6% of children aged 5-9 years have caries, and 28.5% have root caries.⁴ The low knowledge about oral health may cause the high prevalence of caries. Proper tooth brushing is an efficient mechanical means of maintaining oral health.⁵⁻⁷ The Riskesdas 2018 data showed that 93.2% of aged 5-9 years already have good tooth brushing behavior. However, only 1.4% brush their teeth at the right time, namely at least twice, after breakfast and before bed.²

Based on this information, it is necessary to make more efforts to improve dental and oral health in children. Efforts to improve include promotive, preventive, curative, and rehabilitative with active community participation.^{8,9} One way to increase children's positive behavior is to provide good and correct dental health education. These activities can be carried out with appropriate tools or media.

During the Covid-19 pandemic, there are limitations to reaching health facilities, with government policy in the form of social distancing. Therefore, the most appropriate media for education is video, which requires children's modalities, including auditory and

visual. Based on the description above, the researcher is interested in knowing the effectiveness of Dental Health Education (DHE) by using educational video media for Elementary School children to support the discourse on distance education policy plans in the public health sector.

RESEARCH METHODS

This type of research was an experimental analytic with a cross-sectional design using primary data obtained from a questionnaire as an instrument. The questionnaire used has been tested for validity and reliability. It consists of 15 questions with multiple choices in the form of A, B, and C with a value of 1, 2, and 3, respectively. Furthermore, the population was third-grade students at the Alamy Integrated Islamic Elementary School in Subang, with a total of 111 people. Samples are taken by purposive sampling using the Slovin formula, and the number obtained is 53 respondents.

This research was conducted online in November 2021, where students filled out a questionnaire as an oral health pre-test. In addition, the parents gave informed consent, and after students filled out the pre-test, the DHE video media was played for 5 minutes. The questionnaire was then refilled as a post-test with the same questions.

After the data was collected, the Kolmogorov Smirnov normality test was carried out to determine the data value distribution. The data will be analyzed using paired t-tests for differences in children's knowledge levels before and after DHE when the value distribution is normal. However, the Wilcoxon test is performed when the distribution is abnormal. This research has received approval from the Ethics Commission of the Faculty of Dentistry, Trisakti University, with ethics pass certificate Number: 415/S1/KEPK/FGK/10/2020.



RESULTS

Table 1 and 2 showed the characteristics of 52 respondents by age and gender with a minimum 8 years, maximum 9 years and mean 8.62 years, 57.7% are male and 42.3% are female.

Table 1. Characteristics by Age

Age	
Minimum	8
Maximum	9
Mean	8,62

Table 2. Characteristics by Gender

Gender	Frequency	(%)
Male	30	57,7
Female	22	42,3
Total	52	100

Children's oral and dental health knowledge before and after treatment are provided in Figure 1. They have a mean score of pre test 40.0 and post test 42.1. Descriptively, there is an increase in the mean score before and after DHE through the educational video.

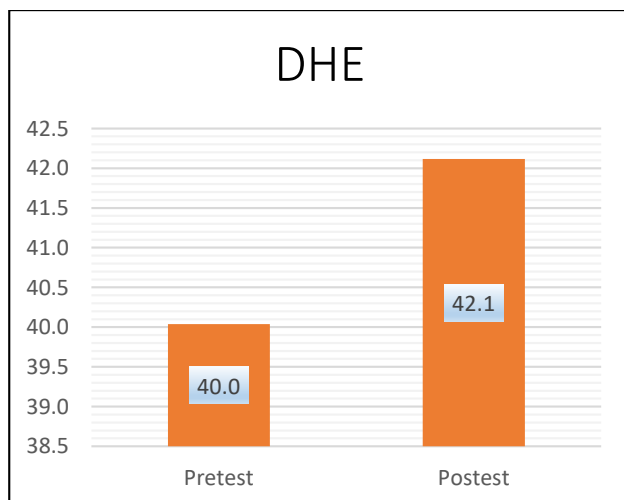


Figure 1. Mean Score of Students' Knowledge Before and After DHE

The normality test results were shown in Table 3. The data in the pre-test and post-test groups are not normally distributed due to a

significance value of less than 0.05. Therefore, the hypothesis will be tested using non-parametric statistics and the Wilcoxon test because the sample in this research is paired.

Table 3. Normality Test

Group	Treatment (DHE)		Conclusion
	Sig.	a-value	
Pre-test	0,004	<0,05	Abnormal
Post-test	0,043	<0,05	Abnormal

Based on the hypothesis test using the Wilcoxon test, the significance value in the pre-test and post-test is less than 0.05. Therefore, "the provision of DHE has a significant effect on children's knowledge about dental and oral health" (Table 4).

Table 4. Hypothesis Test

Group	Mean	P-Value	α-value	Decision	Description
Pre-test	40,0	0.000	<0,05	H ₀ is rejected	Significant
Post-test	42,1				

DISCUSSION

This research aims to analyze the difference between the children's oral health knowledge level before and after DHE using educational video media. Health policy should be integrated and sustainable to maintain and improve the health status of the community, consisting of prevention, health promotion, treatment, and restoration.¹⁰ These efforts can be carried out by providing health education to the community, including children.

The growth in social media use and the increase in children's dental health information on social media may facilitate behavior change and improve children's dental health outcomes. Health promotion media is one of the means used to display messages or information to increase knowledge which is ultimately expected to change behavior towards positive or support health. This research uses video media to attract children's attention. The selection of videos

presented can be adjusted to the material, age, and psychological development of children so that it makes it easier to understand the material. According to literature, video media is the most popular audiovisual media for children and teenagers. Attractive appearance and easy access make videos much liked by children. It will be easier for children to understand and recall the presented material. This matter was in line with Aeni & Yuhandini (2018) that after being given an intervention, students experience a high increase in knowledge.^{11,12}

During the Covid-19 pandemic, direct face-to-face counseling is not possible to prevent the transmission of the virus. Moreover, a distance learning policy inhibits schools from conducting research. Based on these situations and conditions, it is necessary to carry out another approach strategy for children. One alternative is to use tools through the media in the form of educational videos to improve student learning. Compared to other educational media, video is more effective in changing people's behavior about health.^{13,14}

According to the Riskesdas 2018, children aged 8 and 9 years are included in the proportion of the 5-9 year age group, which is the largest with dental and oral problems. This is in accordance with the average age of the respondents, which is 8.62 years. Children aged 8 and 9 years are included in the group of 7-11 years and have acquired cognitive control to understand material effectively. According to Rinintha Adistia et al. (2020), preschoolers have understood the material presented regarding the effectiveness of educational videos in improving the oral hygiene of preschool children aged 4-6 years.¹⁵

The results showed an increase in the value of children's knowledge before (40) and after being given DHE through video media (42.1). Exposure to health education videos can improve people's knowledge, and better mental health related behaviors.¹⁶ The provision of DHE online through educational videos effectively increases children's knowledge about dental and

oral health. DHE is the application of educational concepts to change behavior from unhealthy to healthy and achieve the highest degree of dental health.¹⁷ Furthermore, children aged 8 and 9 can absorb information better because video media suits them. The extensions require children's modalities, including auditory and visual. These media can develop children's learning activities and imagination in a fun atmosphere and stimulate their interest in learning. They are presented in an appealing and simple-to-understand animation for children.¹⁸⁻²⁰ The limitations of the research are due to the pandemic situation, online examination, researchers less able to control the implementation of the pre and post tests. The participant doing the exam at home. Based on the above explanation, online health education media is the best choice during the pandemic to improve Indonesian children's oral health.

CONCLUSION

The children's knowledge about dental and oral health increases significantly after performing DHE through educational video media.

ACKNOWLEDGMENTS

The authors are grateful to Alamy Integrated Islamic Elementary School in Subang, who have assisted in carrying out this research.

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Correction of Central Diastema and Individual Dental Malposition with Removable Orthodontic Appliance

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Online submission : 22 September 2022

Accept Submission : 01 July 2023

ABSTRACT

Background: Central diastema refers to an anterior spacing between maxillary central incisors and malposition of the individual teeth refers to the teeth being crowded in the upper and lower jaws. There are many causative factors that contribute to the occurrence of these two cases, such as heredity, frenulum deformity, gender, and bad habit. Removable orthodontic appliances are devices that can be used in cases of mild malocclusion. **Objective:** The purpose of writing this case report is to show that removable orthodontic appliances are the first choice for dentists. **Case:** A 23-year-old male patient came to UMY Dental and Oral Hospital (RSGM UMY) complaining that his front teeth had spacing and some irregularly arranged teeth. The patient felt uncomfortable with the condition of the teeth. Patient complaints are felt as early as 3 years ago. One year ago, had already used a removable orthodontic appliance and after the treatment is finished then used a retainer but only for 1 month because the retainer is missing. The case of this patient is class I Angle with central diastema and malposition of individual teeth. **Case Management:** Treatment is carried out using removable orthodontic appliances. The appliances component uses a simple spring on tooth 31 and 41, retentive component uses Adam's clasp on teeth 16, 26, 36 and 46. Labial arch with a U loop in between canine and first premolar. **Conclusion:** The removable orthodontic appliance should be used to correct cases of mild malocclusion such as a central diastema with mild malposition of the individual teeth.

Keywords: Removable Orthodontic Appliances, Central Diastema, Mild Malposition of The Individual Teeth

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INTRODUCTION

The development of technology and science for orthodontics is very rapidly developing over time. Increasing public awareness to realize the function of teeth not only for chewing food, but also to support appearance or aesthetics.¹ Orthodontics is a science to correct the position of an untidy tooth caused by dental malposition or an error in the position of the dentition. Some dentists have started to switch to fixed appliances even though orthodontic treatment has its own indications of both fixed and removable appliances. Removable orthodontic treatment can be used for cases of mild malocclusion.²

Diastema is the distance between two or more teeth.³ Types of diastema are central diastema and multiple diastema. Central diastema is the space between incisors centralis. This is caused by several causes such as heredity, frenulum deformity, gender, and bad habits. This central diastema very often causes aesthetic disorders for some people, it is an aesthetic disorder of its appearance, so many people realize and ask for help from the dentist to eliminate the condition. After the central diastema is corrected, it is expected to increase a person's self-confidence.⁴

CASE

A 23-year-old male patient came to the Dental and Oral Hospital of the University of Muhammadiyah Yogyakarta (RSGM UMY) with a complaint that the front tooth over the middle part had a gap ($\pm$ 3 mm) and some mild crowding. The patient was uncomfortable with the condition of the teeth since 3 years ago. Patient has previously been treated with removable orthodontic appliances, but it is not finished when using retainer because it is missed. Patient had the habit of chewing on one side (using the left side) because right molar was cavity and felt sore when eating but the patient has had the tooth filled, the patient returns to

chewing with two sides. The most recent dental treatment performed by the patient was scaling around 11 months ago. Patient brush his teeth 2 to 3 times a day when they wake up in the morning, in the afternoon when taking a shower and the night before going to bed.

According to the patient's confession, the father has a medium jaws size and normal tooth size, the patient's father is healthy and is not suspected of having a history of systemic diseases. The patient's mother is suspected of having a history of malposition teeth and is not suspected of having a history of systemic diseases.

The patient's social life is a student of Magister of Law at UGM Yogyakarta. The patient has a busy life as a construction contractor as well as having an irregular diet. The general medical history of the patient is not suspected of having systemic diseases. The patient in 2015 was once hospitalized due to a blood clot in his brain.

CASE MANAGEMENT

The patient first came to RSGM on March 03rd 2021, for indications then printed. The results of the extraoral examination obtained the results of the patient's head index, namely 83 (mesosphaly) and a face index of 135.2 (hyperleptoprosop). The patient's facial profile was convex with measurements of normal right maxillary Simon lines (1/3 distal C) and left prognathion (1/3 mesial P1) normal right mandible (interdental C-P1) and left prognathion (distal P1). Free Way Space (FWS) of 3 mm (normal) was obtained. The results of the intraoral examination of the patient obtained an overjet of 3.3 mm, an overbite of 3.7 mm. The first molar relation is right: class I Angle, left: Class I Angle. Right canine relation: class I, left: class I. Profile photo of the patient's face as shown in figure 1. Photo of the patient's centrist relationship as shown in figure 2. While the photo looks occlusal as shown in figure 3. The curved shape of the teeth of the upper jaw and lower jaw is parabolic,



symmetrical. Individual dental malpositions of the patient as follows: 24: Dystopalatatorsiversion, 35: Distolabiotorsiversion, 31: Mesiolinguotorsiversion, 41: Mesiolinguotorsiversion, 42: Distolabiotorsiversion, 44: Mesiolinguotorsiversion, 47: Bucoversion. With central diastema between teeth 11 and 21.



Figure 1. Photo of the patient's face.



Figure 2. Photo of the patient's centrist relationship.



Figure 3. Photo of the patient's occlusal.

There were 4 calculations carried out in the case, namely: Pont, Korkhaus, Howes and curvilinear determination. The results of the calculation of Pont are (1) Growth and development in the lateral direction in the inter P1 region experienced a mild contraction of -0.4 mm; (2) Growth and development in the lateral direction of the inter region M1 experienced a moderate distraction of $+5.2$ mm. The result of Korkhaus calculations was growth and development of the dental arch in the anterior direction a mild protraction of $+0.6$ mm. The results of Howes' calculations are: (1) The P index was obtained 44.13% so that the dental arch can accommodate the dentition in an ideal and stable curved state because the P index value $> 43\%$; (2) The Fossa Canina Index (FC) was obtained 47.28% so that the basal arch can accommodate the dentition in an ideal and stable curved state, because the FC index value $> 44\%$. Meanwhile, the results of the calculation of curved determination were obtained: (1) discretion in the upper jaw, namely the right $+2$ mm and the left $+1.2$ mm; (2) discretion on the lower jaw, namely the right -0.8 mm and the left 0 mm. The conclusion of some of these calculations indicated that the patient's condition can be carried out by the administration of removable appliances.

The diagnosis in this case was malocclusion Angle class I Dewey type 1 dentoskeletal accompanied by individual dental malpositions as follows: 24: Dystopalatatorsiversion, 35: Distolabiotorsiversion, 31: Mesiolinguotorsiversion, 41: Mesiolinguotorsiversion, 42: Distolabiotorsiversion, 44: Mesiolinguotorsiversion, 47: Bukoversion. The treatment performed on the patient is an active plate with a short labial arch to correct the diastema. As for the lower jaw, it uses an active plate with a simple spring component to correct the malposition of individual teeth with the design of the tool as shown in figure 4.

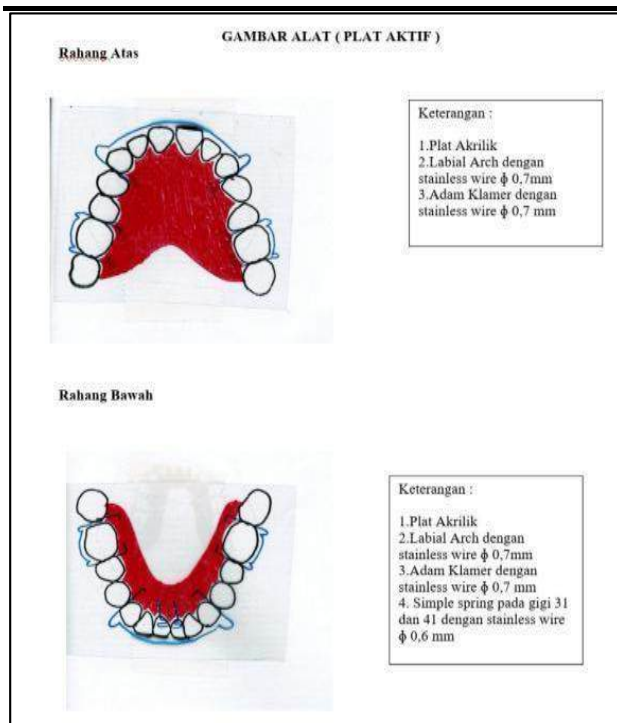


Figure 4. The design of patient's appliances with Adams clasp on teeth 16, 26, 36, 46, labial arch with arm between teeth 13-14, 23-24, 33-34, 43-44.

DISCUSSION

Dental malocclusion can occur when there is a connection between the teeth of the upper jaw and the lower jaw. Dental anomalies, abnormal numbers and dental development can also cause malocclusion, along with genetic, environmental factors and can be due to a person's bad habits.⁵ Malocclusion not only causes one problem in development, but there are many things that occur due to dental malposition, including physical pain, limited movement, poor oral hygiene and can also cause periodontal health, the opportunity for caries, traumatic teeth and the worst problems can cause TMJ problems.⁶ Diastema is a condition in which there is a gap between two teeth. The distance between the midlines of the upper jaw teeth can occur when the teeth mix and the permanent teeth.⁷

The etiology in this case was heredity factor.⁸ In the above description it was stated that the patient's bad habit was not related to the patient's complaint and also the frenulum

attachment of the patient was normal. It has been shown that the treatment carried out to the patient is for eight months with the activation of the appliances or control visits as many as ten times. The operator performed oral hygiene index (OHI) measurements on patients at the beginning of each visit. After that, the operator performed checks on the plate: (1) the effectiveness of the tool; (2) there are parts that are traumatic or not. The operator also performed calculations on the premolar index to see the results of the expansion used. The operator performed control on the patient by scheduling once a week. At the time of control, activation of the simple spring in teeth 31 and 41 was carried out and activation of the labial arch of the upper jaw to close the diastema.

There were changes leading to the patient's ideal occlusion. Individual gear malposition in element 24: mesiolabiotorsiversion (uncorrected); 31: mesiolinguotorsiversion (corrected); 35: distolabiotorsiversion (uncorrected); 41: mesiolinguotorsiversion (corrected), 42: distolabiotorsiversion (uncorrected); 44: distolabiotorsiversion (uncorrected) and 47: bukoversion. The central diastema in 11 and 21 was corrected, the overbite remained 3.7 mm and the overjet corrected from 3.3 mm to 2.7 mm in 8 months (in Figure 5).



Figure 5. changes in the condition of the patient's dental arch to be more ideal.

There are obstacles faced by operators because patients are sometimes not diligent in using appliances, patient has a busy schedule so it is difficult to get to RSGM UMY, the patient

rarely cleans his tools during the beginning of treatment, so the patient should always be educated not to forget to clean the appliances.

CONCLUSION

The treatment carried out on the patient was to use removable orthodontic appliances, in the lower jaws with the addition of simple springs and in the upper jaw, a reduction of overbite was carried out so that the diastema closed. The treatment was declared effective for correcting the patient's dental malposition characterized by closing the diastema as well as correcting the malposition of the patient's teeth leading to the ideal arch.

ACKNOWLEDGMENTS

We thanked Muhammadiyah University Yogyakarta for providing the financial and facilities support for this case and research.

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Effectiveness ZnOE, Ca(OH)₂ and Iodoform as Root Canal Filling Materials for Pulpectomy in Primary Teeth

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Online submission : 04 July 2022

Accept Submission : 17 July 2023

ABSTRACT

Background: Dental caries is a disease that affects almost half of the world's population. A pulpectomy is an endodontic treatment by removing the entire pulp and filling the root canals of primary teeth using an appropriate root canal filling material. Root canal filling material becomes an indicator of the effectiveness of pulpectomy in primary teeth. Operators must comprehend various types of root canal filling materials available in primary dental pulpectomy treatments. **Objective:** This scoping review aims to obtain data on the effectiveness of ZnOE, Ca(OH)₂, and Iodoform paste as root canal filling materials in pulpectomy treatment of primary teeth. **Methods:** This research was a scoping review. By using the PRISMA-ScR study, electronic database searches were conducted on PubMed, EBSCOhost, and Google Scholar. **Results:** A total of 89 articles were identified through a search on PubMed, 137 articles through EBSCOhost, 442 articles through Google Scholar, and 48 articles through a search using Handsearching. The total number of articles identified through all the databases results in 716 articles. Using the PRISMA-ScR flow diagram to do the selection process, it results in seven articles that are eligible for review. **Conclusion:** As root canal filling materials in pulpectomy treatment for primary teeth, ZnOE, Ca(OH)₂, and Iodoform paste were considered effective. The scoping review results in this study showed that Ca(OH)₂ + Iodoform Paste (Metapex®) were better than ZnOE.

Keywords: Iodoform, Root Canal Filling Material, ZnOE, Ca(OH)₂

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INTRODUCTION

According to the 2016 Global Burden of Disease Study, dental and oral problems, particularly dental caries, affect about half of the world's population (3.58 billion people). The prevalence of cavities in early childhood is extremely high, it has reached 93%. It is implying that just seven percent of the children do not have dental caries. The Dental and Oral Health Committee formulated a program for Promotive and Preventive Strengthening via Implementation of the National Caries Free Action Plan 2030.¹ In Indonesia, dental caries is the most prevalent dental and oral condition among children. Caries in primary teeth rapidly expand and expose the pulp. The exposed pulp serves as an access site for microorganisms that can induce inflammation, if this condition persists, the pulp becomes non-vital.² The treatment of primary teeth is crucial for maintaining the space until the time of permanent teeth eruption.³ The treatment of primary teeth with non-vital pulp has become a serious issue for pediatric dentists, with pulpectomy being the most common therapy.

A pulpectomy is an endodontic procedure that involves removing all pulp tissue and filling the root canals of primary teeth with a root canal filling material. A pulpectomy is performed to ease pain, maintain exposed pulp tissue, keep primary teeth in place until permanent teeth are ready to erupt, and improve aesthetics.^{4,5} The selection of the proper root canal filling material is one determinant of endodontic treatment success.

The optimal root canal filler material for pulpectomy must possess multiple qualities. These qualities, which include antibacterial properties, can be absorbed at the same level as root resorption, are harmless to the permanent tooth germ, not irritate the periapical tissue, and are simple to use. The quality of the root canal filling material will result in favorable treatment outcomes.⁶ According to Bahrololoomi et al, there has never been a filler material with optimal qualities.⁷ Srinitya et al⁴ also claim that no

material can be regarded as an optimal root canal filling material. So far, no scoping reviews have been done to look at how well these three-root canal filling materials work.⁴

As root canal filling material is one of the indicators for the effectiveness of pulpectomy in primary teeth, dentists and dental students must be aware of the various root canal filling materials currently used in pulpectomy treatment of primary teeth. Clinicians can select a root canal filling material based on the patient's needs and clinical condition. In this study, Zinc Oxide Eugenol (ZnOE), Calcium Hydroxide (Ca(OH)₂), and Iodoform Paste will be examined as root canal filling materials.

ZnOE is one of the most broadly adopted root canal filling materials for primary teeth. Bonastre (1837) discovered ZnOE, which Chisholm applied in dentistry (1876).¹² ZnOE is the first root canal filling material recommended for primary teeth.⁴ Calcium hydroxide (Ca(OH)₂) has been utilized in dentistry for a very long time, particularly for endodontic treatment. Used in various formulations as a liner beneath restorations and as a pulp capping agent in different pathological conditions.⁸

Iodoform is a halogen compound containing bactericidal, fungicidal, viral, and sporicidal characteristics, as well as rapid tissue penetration and minimal tissue toxicity.⁹ Iodoform is an iodine-type halogen compound. As a mixing agent for iodoform, iodine enhances the antibacterial impact and radiopacity because it shares the same qualities as barium sulfate. These compounds can diffuse across dentin and cementum and aid in tissue repair by activating an immune response.¹⁰ Combining Ca(OH)₂ with Iodoform Paste and adding another oily additive (Vitapex®) demonstrates that the substance is bactericidal and more readily absorbed in the periradicular area. Research has revealed that combining Ca (OH)₂ + Iodoform was the best filling material to be used for pulpectomy in primary teeth nearing exfoliation.¹¹ The addition of Iodoform paste to Ca(OH)₂ serves to increase the radiopacity.^{12,9} The purpose of this scoping review is to provide

information regarding the effectiveness of ZnOE, Ca(OH)₂, and Iodoform paste as root canal filling materials in pulpectomy treatment for primary teeth.

METHODS

A scoping review approach was used to review articles from PubMed, EBSCOhost, and Google Scholar that met the following criteria:

1. Articles that discuss root canal filler materials used in pulpectomy therapy for primary teeth.
2. Articles that elaborate on the usefulness of root canal filling materials in the treatment of pulpectomy of primary teeth.
3. Articles published in the last ten years.
4. Accessible full-text articles.
5. Articles in English and Indonesian.

This scoping review began with a literature search strategy, followed by the determination of inclusion and exclusion criteria, proceeded by screening, and choosing studies using PRISMA-ScR, and lastly, data extraction. The electronic databases PubMed, EBSCOhost, and Google Scholar were searched. The search strategy was conducted based on each database used to identify relevant articles using the AND and OR Boolean operators as well as the limit function of each database if it was available.¹³ Multiple keywords were combined in an online search engine to conduct article searches (Table 1).

The flow of the study selection was shown in Figure 1. The study search was carried out by following the PRISMA-ScR flowchart (Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Review).¹⁵ The first phase entails screening articles based on their titles. The abstract screening will be the next step. Articles that are relevant to the abstract will be included.

The full-text version of the article would choose. For a full-text feasibility aspect screening, full-text articles that can be accessible would be sought and read in- depth.

Data extraction and analysis will be performed on articles that meet all the selection criteria.¹⁶

A search on PubMed revealed 89 articles, a search on EBSCOhost yielded 137 articles, and a search on Google Scholar got 442 articles. There were duplication checks performed, resulting in the collection of 618 items. The first screening was done by reading the title and abstract. 604 papers were selected because they were irrelevant and did not match the inclusion requirements; 14 articles were then retrieved for additional screening. The second screening involved reading the full text for its content. Seven articles were chosen for screening, and seven articles were subsequently obtained for review.

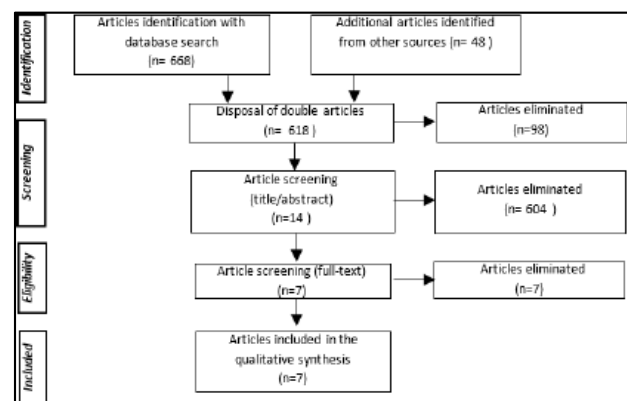


Figure 1. Flowchart of PRISMA-ScR Study Selection

RESULTS

The researcher filtered articles retrieved by collecting articles from database searches, such as PubMed, EBSCOhost, and Google Scholar, to obtain seven articles for further review. Three articles^{22,25,26} revealed that ZnOE was effective. Then, four articles revealed^{319,20,23,24} that Ca(OH)₂ and Iodoform paste were effective. Two research articles^{19,20} were based on a six-month observation period. Observations were conducted for 18 months in the study by Babashi et al²⁴, and for 12 months by Daniele et al²⁵. Numerous obturation procedures were utilized in In Vitro-based research articles. Pasdar, et al²¹ employed spiral lentulo. Orhan et al²³ combined spiral lentulo and ultrasonic stimulation in their work.

The results of the study search and selection resulted in a total of seven studies that matched the inclusion criteria, with the features of the articles from the selected studies shown in Table 2 and a summary of the studies covered in Table 3.

Table 1. Study Search Strategy

Electronic search engine	Search Strategy	Number of search results articles
PubMed	<i>((Zinc Oxide Eugenol OR Calcium Hydroxide OR Iodoform Pastes)) AND (Pulpectomy OR Pulp Treatment OR Obturation OR Caries OR Root Canal)) AND ((Primary Teeth)) Filters: Free Full text, From 2011-2021</i>	89
EBSCOhost	<i>((Zinc Oxide Eugenol OR Calcium Hydroxide OR Iodoform Pastes)) AND (Pulpectomy OR Pulp Treatment OR Obturation OR Caries OR Root Canal)) AND ((Primary Teeth)) Filters : Free Full text, From 2011-2021</i>	137
Google Scholar	<i>Zinc Oxide Eugenol, Calcium Hydroxide, Iodoform Pastes as Root Canal Filling Material in Pulpectomy Treatment of Primary Teeth. Filters: Free Full text, from 2011-2021.</i>	442

Table 2. Characteristics of Articles

Author's Name, Publication Year	Journal Name	Article Title	Research Site	Research Design
Rahaswanti ¹⁸ (2016)	Directory of Open Access Journals	Evaluasi Keberhasilan Pengisian Saluran Akar dengan Sediaan ZnOE dan campuran Ca(OH) ₂ dengan Pasta Iodoform	Indonesia	Before-after two group design
Kalaskar, et al ¹⁹ (2021)	Annals of R.S.C.B	<i>Comparative Evaluation of Effectiveness of Pre- Mixed Syringe and Incremental Technique as a Root Canal Obturating Technique in Primary Mandibular Second Molar– A Randomized Clinical Trial</i>	India	Comparative study
Pasdar, et al ²¹ (2017)	Dental Research Journal	<i>Push-out bond strength of different intracanal posts in the anterior primary teeth according to root canal filling materials.</i>	Iran	In Vitro
Orhan dan Tatli ²³ (2021)	BioMed Researh International	<i>Evaluation of Root Canal Obturation Quality in Deciduous Molars with Different Obturation Materials: An In Vitro Micro- Computed Tomography Study</i>	Turki	In Vitro
Babashahi et al ²⁴ (2019)	Frontiers in Dentistry	<i>Volumetric Assessment of Root Canal Obturation Using 3% Nano-Chitosan versus Zinc Oxide Eugenol (ZOE) and Iodoform- Calcium Hydroxide (Metapex), in Primary Root Canals Shaped with Rotary versus Manual Methods: A Preliminary In- Vitro Spiral CT Study</i>	Iran	In Vitro

Daniele Vieira et al ²⁵ (2019)	Brazilian Oral Research	<i>Iodoform Vs Calcium Hydroxide/ Zinc Oxide based pastes: 12 month Findings of a Randomized Controlled Trial</i>	Brazil	Clinical study
Ou-Yang, et al ²⁶ (2021)	The Journal of Clinical Pediatric Dentistry	<i>Treatment Outcomes of Pulpectomy in Primary Maxillary Incisors Filled with ZOE and Metapex: A Two-year Retrospective Study</i>	Taiwan	Retrospective study

Table 3. A Summary of Studies Examining the Efficacy of ZnOE, Ca(OH)₂, and Iodoform Paste as Root Canal Filling Materials for Pulpectomy of Primary Teeth.

Author's Name, Publication Year	Author's Location	Sample Quantity and Type	Materials	Research Method	Assessment Criteria (Calibration)	Analysis Test	Findings
Rahaswanti ¹⁸ (2016)	Indonesia	16 primary molars	ZnOE and Ca(OH) ₂ + pasta iodoform (Metapex®)	3 months observation	Kriteria Nurko C, Gracia-Godoy F. (1999) clinical and radiographic examination	Dianalisis dengan Uji Fisher's Exact	Ca(OH) ₂ + Iodoform paste (Metapex®) and ZnOE offered promising potential as root canal filling materials for diagnosing pulp necrosis in primary molars.
Kalaskar, et al ¹⁹ (2021)	India	60 primary molars	Ca(OH) ₂ + pasta iodoform (Vitapex®) and ZnOE	Observation for 6 months with clinical and radiographic examination	Kriteria (Coll & Sadrian, 1996) performed by one operator on all tooth samples with a calibration score of 1 for under filling, 2 for optimal filling and 3 for overfilling	Examined by Fisher's Exact Test	Ca(OH) ₂ + Iodoform paste (Vitapex®) showed better obturation quality of primary teeth than ZnOE.
Pasdar, et al ²¹ (2017)	Iran	60 primary incisors	ZnOE and Ca(OH) ₂ + pasta iodoform (Metapex®)	In Vitro	The assessments criteria were determined independently. This was accomplished by examining the push-out binding strength of root canal fillings.	Two-Way Anova Test	ZnOE significantly reduced intracanal post strength compared to Ca(OH) ₂ + Iodoform paste (Metapex®) in root canal filling of primary molars
Orhan dan Tatli ²³ (2021)	Turki	30 primary molars	Ca(OH) ₂ , Ca(OH) ₂ + pasta iodoform (Metapex®) and ZnOE	In Vitro	Feldcamp et al's criteria (1989) with calibration of Micro Computed Tomography image analysis.	Mann Whitney Test dan Kruskal Test	Ca(OH) ₂ + Iodoform (Metapex®) improved obturation quality in primary molar fillings compared to ZnOE.

Babashahi et al ²⁴ (2019)	Iran	152 root canals of primary molars	ZnOE, Ca(OH) ₂ + pasta iodoform (Metapex®) and nano-chitosan	In Vitro	Self-made criteria with calibration of Micro Computed Tomography image analysis.	Descriptive statistics with ANOVA. test	Ca(OH) ₂ + iodoform paste (Metapex®) was preferable to ZnOE material for filling the root canal of primary molars.
Daniele Vieira et al ²⁵ (2019)	Turki	27 primary molars	Iodoform pasta, Calen®/ Zinc Oxide and Ca(OH) ₂	Observation for twelve-month with clinical and radiographic	Kriteria were judged by Barcelos et al (2012). Clinical success was deemed the absence of signs or symptoms of infection, such as pain, swelling, fistula, or sensitivity to percussion	Descriptive analyses	Iodoform pasta atau Calen®/ZO outcomes indicated successful treatment, although the frequency of ideal level of the root canal filling was higher in Calen®/ZO group.
Ou-Yang, et Al ²⁶ (2021)	Taiwan	309 primary molars	ZnOE and Ca(OH) ₂ + pasta iodoform (Metapex®)	Observation for 12 and 24 months	Criteria of Smail-Faugeron, et al (2013) with clinical and radiographic	Multivariate analysis using multiple logistic regression.	ZnOE is preferable to use than Ca(OH) ₂ + iodoform paste (Metapex®).

Seven articles evaluated utilized ZnOE, Ca(OH)₂, and Iodoform paste. There were additional materials, nano-chitosan, and endoflas, in one study.²⁴ Rahsawanti¹⁹ with a research article entitled "Evaluation of the Success of Root Canal Filling with ZnOE and Ca(OH)₂ Mixture with Iodoform Paste" located in Indonesia using a before-after two-group design study and observation for 3 months and a total sample of 16 primary molars. The results showed that Ca(OH)₂ + Iodoform Paste (Metapex®) and ZnOE had good potential as root canal filling materials for primary molars for diagnosis of pulp necrosis. Kalaskar presented similar results²⁰ in India, with the research title Comparative Evaluation of Effectiveness of Pre-Mixed Syringe and Incremental Technique as a Root Canal Obturating Technique in Primary Mandibular Second Molar – A Randomized Clinical Trial with a total sample of 60 primary molars and a comparative study design observation for 6 months of clinical and radiographic trials stated that Ca(OH)₂ + iodoform paste (Vitapex®) showed better

obturation quality of primary teeth compared to ZnOE.

Pasdar's²¹ in Iran, Orhan and Tatli²³ in Turki, and Babashahi²⁴ in Iran, all of them employed in vitro research methods. Pasdar²¹ with the research title "Push-out bond strength of different intracanal posts in the anterior primary teeth according to root canal filling materials" using a sample of 60 primary incisors showed that ZnOE significantly reduced intracanal post strength compared to Ca(OH)₂ + iodoform paste (Metapex®) in root canal filling of primary molars.

The research by Orhan and Tatli²³ entitled Evaluation of Root Canal Obturation Quality in Deciduous Molars with Different Obturation Materials: An In Vitro Micro-Computed Tomography Study with the samples of 30 primary molars found that Ca(OH)₂ + Iodoform (Metapex®) improved the obturation quality of filling primary molars compared to ZnOE. Babashahi's study²⁴ entitled Volumetric Assessment of Root Canal Obturation Using 3% Nano-Chitosan versus Zinc Oxide Eugenol (ZOE) and Iodoform- Calcium Hydroxide

(Metapex), in Primary Root Canals Shaped with Rotary versus Manual Methods: A Preliminary In- Vitro Spiral CT Study and a sample of 152 root canals of primary molars showed that $\text{Ca}(\text{OH})_2$ + iodoform paste (Metapex®) was preferable in filling the root canals of primary molars than ZnOE material.

Research by Daniele Vieira²⁵ in Turki entitled Iodoform Vs Calcium Hydroxide/ Zinc Oxide based pastes: 12 month Findings of a Randomized Controlled Trial Study with a sample of 27 primary molars using Observation for twelve-month with clinical and radiographic found that Iodoform pasta atau Calen®/ZO outcomes indicated successful treatment, although the frequency of ideal level of the root canal filling was higher in Calen®/ZO group.

Research by Ou-Yang²⁶ in Taiwan entitled Treatment Outcomes of Pulpectomy in Primary Maxillary Incisors Filled with ZOE and Metapex: A Two-year Retrospective Study and a sample of 309 primary molars with a retrospective study of 12 and 24 months observation resulted that ZnOE was better used than $\text{Ca}(\text{OH})_2$ + iodoform paste (Metapex®).

DISCUSSION

The findings of the seven articles reviewed discovered four articles^{19,20,23,24} indicating $\text{Ca}(\text{OH})_2$ + Iodoform Paste (Metapex®) was more effective as a root canal filling agent for primary molars compared to ZnOE. The four studies employed $\text{Ca}(\text{OH})_2$ + Paste Iodoform (Metapex®) with the same composition: a mixture of $\text{Ca}(\text{OH})_2$, iodoform, and silicone oil, as well as ZnOE with the same composition: a mixture of zinc oxide powder, rosin, zinc acetate, and liquid eugenol. The hydrophobic and lipophilic nature of ZnOE made it easy for it to enter the bacterial cell membrane by increasing the permeability of the bacterial cell membrane, causing the bacterial cell membrane to become damaged, allowing macromolecules and bacterial ions to easily leave the cell, causing the bacterial cell to be damaged and die. Impaired cell membrane

permeability inhibited bacterial protein synthesis, resulting in a change in protein structure and the protein's inability to function. Protein denaturation occurred when proteins failed to function, followed by protein coagulation, which disrupted bacterial metabolism and caused bacteria to die.²⁸⁻²⁹ $\text{Ca}(\text{OH})_2$ stimulated the production of hard tissue by releasing Ca^{+} ions, whereas the antibacterial action was produced by releasing OH^{-} ions, resulting in an elevation in pH, which caused bacterial cell wall destruction.³¹ Iodoform is an iodine-type halogen compound. Because it has the same qualities as barium sulfate, iodine as an iodoform mixing agent increases the antibacterial impact and increases radiopacity. These chemicals can penetrate across dentin and cementum and aid in tissue regeneration by activating an immune response.¹⁰

$\text{Ca}(\text{OH})_2$ + Iodoform Paste (Metapex®) and ZnOE were excellent root canal filling agents because promoted faster healing.¹⁷ $\text{Ca}(\text{OH})_2$ + Paste Iodoform (Metapex®) was superior in the healing process, binding strength to root canals, absorbed faster, and filled root canals better than ZnOE.^{20,23,24} It can be concluded that $\text{Ca}(\text{OH})_2$ + Iodoform Paste (Metapex®) is considered to have more ideal material criteria compared to ZnOE despite disadvantages such as a relatively high material cost. $\text{Ca}(\text{OH})_2$ + Iodoform Paste (Vitapex®) to ZnOE in an experiment. Post-pulpectomy teeth were used with $\text{Ca}(\text{OH})_2$ + Iodoform Paste (Vitapex®) filled with a syringe, while ZnOE used incremental, which showed that the overall results of the comparison of the two substances with this technique showed a significant difference in obturation quality. When compared to ZnOE, the application of $\text{Ca}(\text{OH})_2$ + Iodoform Paste (Vitapex®) with a syringe resulted in improved root canal filling, cavity closure, clinical and radiographic results.²⁰ ZnOE has the disadvantage of using the incremental technique, which is difficult to apply to narrow root canals. There has been no research done using $\text{Ca}(\text{OH})_2$ + Iodoform Paste (Vitapex®) as an obturation strategy that analyzes obturation time using the syringe approach.²² However, the

advantage of the syringe technique is that the disposable needle tip can avoid contamination of the substance, and the thin and flexible needle tip allows the obturating material to flow freely into the root canal and push the obturating material into the canal.²²

Different from the four studies^{19,20,23,25}, which all concluded that Ca(OH)₂ + Paste Iodoform (Metapex®) was more effective than ZnOE. According to research conducted by Ou-Yang et al²⁶, ZnOE was a more effective root canal filling material for primary molars than Ca(OH)₂ + Iodoform paste (Metapex®). ZnOE substance had a greater success rate than Ca(OH)₂ + Iodoform Paste (Metapex®) in controlled clinical trials at 12 and 24 months, while Ca(OH)₂ + Iodoform Paste (Metapex®) exhibited clinical signs such as pain and soft tissue pathosis at 24 months.²⁶

Based on the findings of the seven articles discussed above, it is possible to infer that Ca(OH)₂ + Iodoform Paste (Metapex®) and ZnOE were suitable root canal filling material for primary molars. The scoping review results in this study showed that Ca(OH)₂ + Iodoform Paste (Metapex®) were better than ZnOE. This was because Ca(OH)₂ + Iodoform has advantages including faster healing,¹⁹ more effective antibacterial, faster absorption ability,²³ and was effective in filling the volume of the dental canal as well as high sealing potential which contributes to clinical success.²⁴ These findings was consistent with the findings that Iodoform + Ca(OH)₂ filling materials showed better clinical and radiographic performance when compared to non-iodoform-based filling materials in the short term, and similar performance in the long term.²⁷

This scoping review has a limitation in that the variability of results may be attributable to the assessment and method of pulpectomy in primary root canals using different criteria. Variations were seen in the number of samples, type of molars, and treatment control duration. The inclusion and exclusion criteria of each study can also contribute to the variation in outcomes. In fact, this study did not assess the quality of the

articles, allowing for a substantial amount of bias in the selection of the publications that were examined.

CONCLUSION

As root canal filling materials in pulpectomy treatment for primary teeth, ZnOE, Ca(OH)₂, and Iodoform paste were considered effective. The scoping review results in this study showed that Ca(OH)₂ + Iodoform Paste (Metapex®) were better than ZnOE.

ACKNOWLEDGMENT

We would like to express our gratitude to drg. Faisal Kuswandani., Apt,M.Kes., Dr.drg. Kosterman Usri., MM., and drg. Fajar Fatriadi, M.Kes. for the contribution of this research.

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Effectivity of Calcium, Phosphate and Vitamin D in Dental Caries Prevention

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Online submission : 01 March 2022

Accept Submission : 16 December 2022

ABSTRACT

Background: Micronutrient elements are vitamins and minerals that are required in small amounts but play important roles in our body. Insufficient micronutrients can affect health including dental health. **Objective:** Analyzing effectiveness of micronutrients (calcium, phosphorus, and vitamin D) in preventing dental caries. **Literature study:** This literature study was conducted from Google Scholar, Science Direct, and Pubmed (MEDLINE). The strategy used in literature collection is in the form of writing keywords that are used to find articles to be reviewed with a publication period between 2012 - 2020. **Discussion:** Dental caries is a demineralization of an inorganic part of the tooth due to a multifactorial etiology and occurs when demineralization exceeds remineralization. The calcium and phosphorus ions level in the saliva could affect the balance between demineralization and remineralization of enamel and its deficiency can strongly influence morphology of the tooth. It has been found that calcium level significantly influences hard dental tissues defense mechanisms. On the other side, vitamin D also plays an important role to form enamel and dentin in the tooth development process because of its receptor in ameloblasts and odontoblasts. Deficiency of vitamin D can cause enamel hypoplasia which is a significant factor for early childhood caries. **Conclusions:** Calcium, phosphorus, and vitamin D significantly affecting the demineralization and remineralization process. The optimum concentration and level of calcium, phosphorus, and vitamin D in the body effectively increase the tooth defense mechanism and reduce the dental caries.

Keywords: Calcium, Phosphorus, Vitamin D, Dental Caries

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INTRODUCTION

Micronutrient elements are those vitamins and minerals that are required in small amounts in our body which play important roles such as the production of enzymes, hormones, and other substances, that are generally recommended for a dietary allowance (RDA) in mg / day and can enter the body through the respiratory tract, drinking water, and food components.¹ Insufficient intake of micronutrients can affect health, function, and physical and cognitive development throughout the life cycle. Dental caries is a localized and progressive destructive disease of the teeth.² Acid produced by bacteria, especially *Streptococcus mutans* and *Lactobacillus* which causes demineralization due to the fermentation process of dietary carbohydrates.²

Dental caries is the most common chronic disease among youth aged 6–19 years. The prevalence of total dental caries from National Health and Nutrition Examination Survey (NCHS) in 2015-2016 for primary or permanent teeth among youth aged 2–19 years was 45.8%. Prevalence increased with age, going from 21.4% among youth aged 2–5 to 50.5% among those aged 6–11 to 53.8% among those aged 12–19.³ Based on the data above, it is necessary to prevent dental caries through the effectiveness of intake of micronutrients, which are vitamins and minerals. In the relationship between dietary mineral intake and oral disease. The mineralization of teeth depends on a large number of micronutrient factors, of which vitamin D, calcium and phosphorus play an important role.³

Vitamin D is a steroid hormone with pleiotropic effects on calcium and phosphorus metabolism and the immune system. Calcium deficiency is usually due to vitamin D deficiency, either through dietary deficiency or lack of exposure to sunlight.⁴ It can also be due to a diet low in calcium. In this dental caries case, the concentration of calcium (Ca) and phosphorus (P) from dental plaque and levels of Ca and P

ions in saliva can affect the balance of demineralization and remineralization of enamel. High levels of Ca in plaque are associated with a lower incidence of caries. Other vitamins than vitamin D may play another important role as suggested vitamin B6 which can play a role in the prevention of dental caries.⁵ In addition, Vitamin K is another promising candidate for protection against dental caries.⁶ Through this article, the authors want to provide a narrative overview on the effectiveness of calcium, phosphate, and vitamins in dental caries prevention. In order to find the effect of Ca, P and vitamins for preventing caries, and to determine the correlation between optimum concentration and amount of Ca, P, and vitamins to perform maximum effect of dental caries prevention. The main database searched is focused on systematic reviews about micronutrients (minerals and vitamins) and other articles in PubMed and Google Scholar which were published in English, dated from the year 2010 to 2020 were included in this article review.

The Role of Ca in Remineralization and Demineralization

Caries occur when demineralization exceeds remineralization. Remineralization of white-spot lesions may be attainable with presently available agents possessing fluoride, calcium and phosphate, and casein phosphoprotein amorphous calcium phosphate.⁷ Calcium, phosphate, and fluoride ions play an important role in the battle between demineralization and remineralization processes and accordingly modify the susceptibility of tooth to caries progression. During demineralization, calcium release precedes phosphate release from enamel, dentin, and cementum. Therefore, using calcium rather than phosphate to suppress the demineralization process would be effective.⁸ Study from Adegboye *et al.* stated that higher calcium intake may also enhance enamel remineralisation, reduce demineralization.⁹

Saliva is supersaturated with calcium and phosphate with a pH equal to 7, a level that



favors remineralization. When acid stimulation is too strong demineralization prevails until the formation of a carious lesion.¹¹ Studies from Philippe and Lingstrom stated that Vitamin D, calcium, and phosphate play a major role in remineralization.¹⁰ However, remineralization of enamel by saliva is seldom completely achieved, especially when there is an imbalance in duration and extent of demineralization/remineralization phases. Therefore, it is required the use of an external source of Ca^{2+} and PO_4^{3-} ions to increase the Hydroxyapatite supersaturation to efficiently prevent demineralization and boost remineralization.¹¹

The calcium concentration of dental plaque strongly influences the balance between demineralization and remineralization of enamel. In an epidemiological study, Gedalia and colleagues, in a controlled clinical trial in children, demonstrated that eating a 5 g piece of hard cheese daily, following breakfast, for a period of 2 years, resulted in the development of significantly less caries. Cheese stimulates salivary secretion and increases plaque calcium concentration.¹²

The Role of Phosphorus in Remineralization and Demineralization

Presence of microbial acid products can reduce hydroxyapatite, marked by formation of porosity on tooth enamel. Porosity on tooth enamel can be fixed by using calcium and phosphate ions.⁸ Hydrogen ion binds to phosphate ion on hydroxyapatite and produce HPO_4^{2-} , and this ion cannot be balanced with normal hydroxyapatite bonds and cause some of the enamel hydroxyapatite crystals dissolve and cause the enamel to become brittle. This demineralization process can be inhibited by remineralization, neutralize pH and sufficient calcium and phosphate to restore the minerals that have been broken down.¹³

Remineralization of enamel is known to be performed by phosphate and calcium from saliva.¹⁴ There are two calcium phosphate

compounds that can induce remineralization. It is casein phosphopeptide-amorphous calcium phosphate (CPP-ACP) which is formed by casein phosphopeptide (CPP) that aggregates with calcium phosphate and forms an amorphous calcium phosphate (ACP). The aggregation between these two compounds results in remineralization and prevents demineralization.¹⁵

The Role of Vitamin D in Remineralization and Demineralization

Another micronutrient related to caries prevention is vitamin D. Various studies have shown that vitamin D has an important role in development of bones and teeth. Vitamin D acts as a regulator of calcium levels in craniofacial development and maintenance of good oral health. In the body, calcium and phosphorus can be found in enamel, the most mineralized substance. Calcium and phosphorus are obtained from food with the help of vitamin D as an absorption agent. The absorption of calcium and phosphorus helps improve the strength of the teeth and surrounding bones.¹⁶ Ameloblasts and odontoblasts, which are known to form enamel and dentin, also has vitamin D receptors.¹⁶ Ameloblasts and odontoblasts are the target cells for 1, 25-dihydroxyvitamin D, the active form of vitamin D. If there is a deficiency of vitamin D during the period of tooth development, one of the effects is developmental damage such as enamel hypoplasia. This enamel hypoplasia is a significant risk factor for severe early childhood caries.¹⁷ If metabolism and levels of this vitamin are irregular, "rachitic teeth" can occur too. This condition causes the teeth to be hypomineralized and damaged, making them prone to fractures and decay.^{18,19}

In addition, vitamin D is also associated with one of major oral diseases, caries.¹⁷ Vitamin D can help reduce the risk of dental caries by playing an important role in the mineralization of bones and teeth. As a mineralized organ, teeth are surrounded by 3 hard tissues, namely

cementum, dentin, and enamel. Vitamin D systemically acts as an initiator of signaling pathways via the vitamin D receptor, a transcription factor that controls gene expression via the element vitamin D.²⁰ Vitamin D will increase vitamin D receptor to induce structural gene products, such as calcium binding proteins and various extracellular matrix proteins (eg, dentine phosphoproteins, dentin sialoglycoproteins, enamel, and amelogenin) to form dentin and enamel.¹⁸ This responsive gene also affects mineral and energy metabolism, bone, skeletal muscle, cell life cycle and migration, immune response, and detoxification.^{20, 21,22} The role of vitamin D in tooth mineralization can also be seen since the fetus is in the womb. In the condition of pregnant women, fetal primary teeth can be affected by maternal 25 (OH) D levels because systemic levels of vitamin D in fetal serum will follow maternal concentrations.^{23,24} Thus, maternal vitamin D levels can be used as a standard surrogate marker for the fetus. If any condition causes maternal 25 (OH) D levels to be imbalanced, fetal levels can also be directly affected by the health of the baby especially tooth development.^{23, 24, 25, 26, 27 27, 28}

Research revealed that a higher maternal vitamin D intake during pregnancy will result in a lower risk of dental caries in children because maternal prenatal 25-hydroxyvitamin D [25OHD] has the potential to have an effect on primary teeth and the development of ECC.^{23, 29} Pregnant women with vitamin D supplementation levels below 15 ng / mL were also found to have a 14% higher risk for primary teeth.²⁷ About 50% of the potential for enamel damage will decrease if vitamin D supplementation is given in sufficiently high doses during pregnancy.^{26, 29} Maternal vitamin D deficiency will form a pattern of associated mineralization defects at the particular week of pregnancy when vitamin D deficiency occurs. For example, maternal vitamin D deficiency status could affect the beginning of primary maxillary central incisor calcification if vitamin D

deficiency occurs at 13 weeks from conception. It could potentially lead to a hypoplastic/mineralization defect in the incisal third of the crown. One study also showed defects in the incisal third, middle third and cervical one third because of maternal deficiency of vitamin D at 12-16, 20-32 and 36-40 weeks.²⁷

DISCUSSION

Dental caries is a demineralization of the inorganic part of the tooth with the dissolution of the organic substance due to a multifactorial etiology and occurs when the organic acids produced increase the solubility of the calcium hydroxyapatite that is present in the hard tissue of teeth.³¹ High concentrations of calcium in plaque or saliva may reduce bacterial adhesion to enamel and inhibit bacterial biofilm formation. Studies done by Glass RL, et al. stated calcium was associated negatively with caries experience.³⁰ Another study from Scardina and Messina stated that calcium, phosphorus, and casein contained in cow milk inhibit caries.³¹

Increase in calcium level in the remineralization solution may enhance the deposition velocity of minerals in the caries lesion. Study from Sejdini et al., 2018 stated that the Ca concentration before and after saliva stimulation and the quantity of Ca before and after saliva stimulation have shown a high correlation. Calcium level significantly influences hard dental tissues defense mechanism and the increase of caries number, the calcium level decreases.³² On the other side, deficiency in phosphate is known to induce rickets.³³ In terms of the relationship between dietary mineral intake and oral disease, the calcium (Ca) and phosphorus (P) concentrations of dental plaque and the levels of Ca and P ions in the saliva could affect the balance between demineralization and remineralization of enamel. The normal level of calcium is 1-2 mmol / L. Based on the study conducted by Lisna and Nisak, the results showed that the salivary calcium level in the caries group was $0.98 \pm$



0.310 mmol / L and in the caries-free group was mmol / L 1.55 ± 0.312 . This study showed that there was a significant difference ($p < 0.05$) between the salivary calcium levels in the caries and caries-free groups.³⁴ Saliva is a major source of minerals that demineralised enamel rebuilds. The hydroxyapatite (HA) crystals in tooth enamel, consisting of Ca, Mg, and Pi (phosphate) are more susceptible to dissolution by acids. Ca assists this process by providing F with a place to bind with. Minerals in drinking water are the main source of Ca and Mg which are absorbed by the body.³⁵ The optimum Ca in drinking water that is beneficial for health ranges from 40-80 mg / L. Ca concentration in saliva to help repair early carious lesions ideally should not exceed 90 mg / L. Ca and F together caused 45% decrease in DMF-S index, supporting the role of Ca in teeth remineralisation.³⁶

The recommended level of phosphate intake for adults and elderly in the United States is 700 mg/day, although studies shown that around 35% of the US adult population consume more than double the amount of phosphate than the recommended amount.³⁷ In a study that was conducted on 8317 school children (average age : 9.99 ± 0.68 years), the occurrence of dental decay was significantly higher among children who consumed a higher amount of phosphate. The study found that after adjusting all the covariates, for every single unit increase in calorie-adjusted sugar intake, the odds of having dental decay increased by 12%, and for 1 unit increase in phosphate, the odds of having any dental decay increased by 33%. In a subgroup analysis, dental decay occurrence increases significantly in children who consumed low sugar and high phosphate compared to children who consumed low sugar and low phosphate, and it implicates that excessive phosphate consumption alone can propagate dental decay, even when sugar consumption is low.³⁸

Vitamin D can be obtained through endogenous synthesis, exogenous attainment of diet, and supplementation. Vitamin D intake is important to fulfill because it affects the

formation of enamel, dentin, and oral bones.¹⁷ The optimal concentration of vitamin D (≥ 75 nmol / L) has been shown in several studies to reduce the potential dental caries in children.^{17, 39, 40} Studies conducted by Schroth et al. (2013) stated that caries-free children were twice as likely to have optimal vitamin D concentrations (≥ 75 nmol / L) and those with severe early childhood caries were nearly three times more likely to have deficiency rates (< 35 nmol / L). The results of another study indicated that vitamin D supplementation reduced the risk of caries by about 47%, but with low certainty.³ Although serum vitamin D is unable to change the main structure of teeth, it turns out that vitamin D is able to prevent caries by regulating immunity through eradication of microbes with peptide activity.⁴¹

To get the overall benefits of vitamin D, the experts committee of National Academies of Sciences, Engineering, and Medicine developed intake recommendations for general vitamin D in the Reference Diet Intakes (DRI). Reference values used in planning and assessing nutritional intake vary according to age and sex for healthy people, such as the Recommended Dietary Allowance (RDA) indicator. RDA indicates the average daily intake level is sufficient to meet the nutritional needs of almost all (97%–98%) healthy individuals.

Table 1. Recommended Dietary Allowances (RDAs) for Vitamin D

Age	Male	Female	Pregnancy	Lactation
0-12 months*	10 mcg (400 IU)	10 mcg (400 IU)		
1-13 years	15 mcg (600 IU)	15 mcg (600 IU)		
14-18 years	15 mcg (600 IU)	15 mcg (600 IU)	15 mcg (600 IU)	15 mcg (600 IU)
19-50 years	15 mcg (600 IU)	15 mcg (600 IU)	15 mcg (600 IU)	15 mcg (600 IU)
51-70 years	15 mcg (600 IU)	15 mcg (600 IU)		
>70 years	20 mcg (800 IU)	20 mcg (800 IU)		

RDAs are often used to plan a diet that is nutritious enough for an individual. RDAs for vitamin D indicate daily intakes sufficient to maintain normal calcium metabolism and bone health in healthy people. RDAs for vitamin D are written in both international units (IU) and micrograms (mcg) (Table 1), which 1 mcg of vitamin D is equal to 40 IU.⁴²

CONCLUSION

Calcium (Ca), phosphorus (P), and Vitamin D are part of micronutrients which has an important role in tooth remineralization and demineralization. Both calcium and phosphorus significantly influence tooth defense mechanisms, while vitamin D influences tooth development. Calcium and phosphorus concentrations could affect the balance between demineralization and remineralization of enamel. Vitamin D helps obtain calcium and phosphorus to improve the strength of the tooth and help to reduce the risk of dental caries by its important role in mineralization. Therefore, calcium, phosphorus, and vitamin D on their optimum intakes, concentration, and level in the body could work effectively in preventing dental caries.

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Management of Oral Candidiasis in People Living with HIV

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Online submission : 26 June 2022

Accept Submission : 02 August 2023

ABSTRACT

Background: The incidence of HIV/AIDS has increased significantly over the last decade, both globally and in Indonesia. In this situation, the patient has severe impairment in their cellular immunity, making them susceptible to various kinds of opportunistic infections. Oral candidiasis is the most common oral lesion related to HIV/AIDS. Oral candidiasis in people living with HIV (PLHIV) needs to be treated because it can evolve into a systemic infection through the lymphatic system that attacks vital organs. **Objective:** To know the management of oral candidiasis in PLHIV. **Methods:** A web-based search was performed via the PubMed, ScienceDirect, and Google Scholar database. Original research and case reports (2018–2023) published in the English language were included to appraise various topics. The number of articles included in the review amounted to 9 articles. **Literature Study:** Management of patients with oral candidiasis in PLHIV by eliminating predisposing factors, improving oral hygiene, and administering antifungal drugs such as topical agents and/or systemic triazoles. **Discussion:** In cases of oral candidiasis associated with immunodeficient individuals, topical agents may not be effective in such cases, hence triazole systemic administration is necessary. Oral candidiasis in PLHIV is less responsive to polyene antifungal drugs (nystatin and amphotericin B). **Conclusions:** Management of oral candidiasis in PLHIV sufferers are eliminating predisposing factors, Improving oral hygiene and stopping habits that can worsen the patient's oral hygiene, administration fluconazole antifungal drugs, giving chlorhexidine gluconate mouthwash, and antiretroviral (ARV) treatment.

Keywords: Antifungal Drugs, Azole Systemic, Oral Candidiasis, HIV

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INTRODUCTION

Human Immunodeficiency Virus (HIV) is a type of virus that infects CD4 cells, which causes a decrease in human immunity. Acquired Immune Deficiency Syndrome (AIDS) is a symptom that arises because of decreased immunity caused by HIV infection¹. HIV/AIDS is a serious global epidemic problem and needs to be addressed because HIV/AIDS is a case of secondary immune deficiency disease that often occurs and is the most common in the world.²

The incidence of HIV/AIDS has increased significantly over the last decade, both globally and in Indonesia. In this situation, the patient has severe impairment in their cellular immunity, making them susceptible to various kinds of opportunistic infections.³ Oral candidiasis is the most common oral lesion associated with HIV/AIDS.⁴ Opportunistic infections caused by fungi are either the cause of high morbidity and mortality rates and decreased quality of life of HIV/AIDS patients.³

The prevalence of candidiasis in Indonesia is around 20-25%. According to data from the Mycology Division of the Outpatient Skin and Sexual Health Unit, Dr. Soetomo Surabaya In 2013–2016, there were 16 patients suffering from oral candidiasis with a percentage of 5.3% of the total candidiasis cases⁵. According to research from an oral observational clinical examination of patients at RSUD Dr. Soetomo Surabaya in 2011–2012, there were 41 cases of oral pseudomembranous candidiasis (47.13%), 10 cases of angular cheilitis (11.49%), and 4 cases of Chronic hyperplastic candidiasis (4.59%).⁶

Fungal opportunistic infections in people living with HIV/AIDS (PLHIV) are a major cause of morbidity, mortality, and reduce the quality of life of these individuals.⁷ Oral candidiasis in PLHIV needs to be treated not only because of the discomfort of PLHIV but also because the foci can act as reservoirs for spread. In patients with severe immunodeficiency it is necessary to prevent colonization and infection, because the

oropharyngeal area can be a major source of initial colonization and allows the spread of infection later.⁸

Early diagnosis and appropriate treatment of oral lesions have a major impact on the patient's general health and can reduce disease mortality. It is therefore important for dentists to have the necessary knowledge and expertise to manage the oral manifestations of HIV infection.⁹

METHODS

A web-based search was performed via the PubMed, ScienceDirect, and Google Scholar database with the keywords (((Management) OR (treatment)) AND ((Oral Candidiasis) OR (candidosis))) AND (((HIV) OR (PLHIV)) OR (People Living with HIV)). Original research and case reports (2017–2023) published in the English and Indonesia language were included to appraise various topics. The findings are noted in the following subsections.

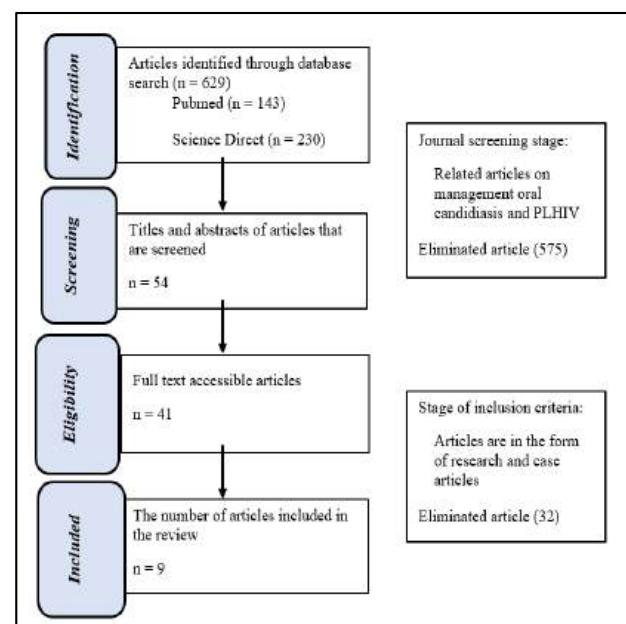


Figure 1. Article selection flow chart

Figure 1. shows the selection of articles on searches through a database with predefined keywords. The results of the articles obtained reached 453 articles. However, there were 399

articles that did not discuss the topic of management oral candidiasis and PLHIV, so they were not included in the search, which were then excluded. The number of articles included in the review amounted to 9 articles.

REVIEWS

HIV and AIDS

HIV targets the immune system and weakens people's defense against many infections and some types of cancer that people with healthy immune systems can fight off. As the virus destroys and impairs the function of immune cells, infected individuals gradually become immunodeficient. Immune function is typically measured by CD4 cell count¹⁰. HIV is a cytopathic virus classified in the Retrovirus family, subfamily Lentivirinae, and genus Lentivirus. Two types of HIV can cause AIDS, namely HIV-1 and HIV-2¹¹. Clinical and laboratory studies are more often carried out on HIV-1 because HIV-1 is more often found than HIV-2.¹²

AIDS is the most advanced stage of HIV, which has taken many years to develop if HIV is not treated, depending on the individual. AIDS is defined by the development of certain cancers, infections, or other severe long-term clinical manifestations.¹⁰

Oral Manifestations of HIV/AIDS

Patients with HIV/AIDS will experience immunodeficiency along with the stages of HIV. After the initial infection, a person with HIV/AIDS may not feel any symptoms, after the second stage usually symptoms will begin to appear. If you have reached the AIDS stage, then opportunistic infections will begin to manifest due to the failure of the body's defenses¹³. Oral manifestations of HIV/AIDS have a negative impact on the quality of life of infected patients and make it difficult to treat various systemic disease¹⁴.

Oral manifestations such as oral candidiasis (OC), oral Hairy leukoplakia (OHL),

necrotizing ulcerative gingivitis, and necrotizing ulcerative periodontitis Kaposi's sarcoma, non Hodgkin's lymphoma, linear gingival erythema, are strongly associated with HIV and have been identified internationally, and also the earliest and most important indicators of HIV infection⁴.

Oral Candidiasis

Oral candidiasis is caused by an overgrowth of *Candida* and Oral candidiasis is an opportunistic infection of the oral cavity. *Candida* yeast is part of the normal flora found in the body, which generally does not cause symptoms.¹⁵ The pathogenesis is not fully understood, but several predisposing factors have been shown to change *Candida albicans* from normal commensal flora (saprophytic stage) to pathogenic organisms (parasitic stage) in oral candidiasis¹⁶. Oral candidiasis levels may be elevated in PLHIV. Oral candidiasis is the most common opportunistic infection in PLHIV and is often associated with an early manifestation of HIV infection symptoms.¹⁷

Candida albicans often cause oral candidiasis, but oral candidiasis can also be caused by *Candida glabrata*, *Candida krusei*, and *Candida tropicalis*¹⁵. *Candida* species are normal flora found in the human body, but they can also cause various infections in susceptible patients (elderly patients, patients who require hospitalization, or patients with immunodeficiency).¹⁸ In the situation where candida can cause various infections due to the balance of a person's normal flora being disturbed, then the commensal nature of *Candida* can turn into a pathogen.³

Oral candidiasis can be diagnosed based on the clinical condition of the lesion and the detection of the lesion by a professional who can be confirmed by microscopic identification of candida. Available techniques for the isolation of oral *Candida* include Direct examination or cytologic smear, microorganism culture, biopsy, histology stained with periodic acid-Schiff (PAS), and PCR studies.¹⁹ The diagnosis of candidiasis can be influenced by the time of

sampling and the way the specimen is handled. Immune function tests are indicated, especially in patients with HIV or chronic mucocutaneous candidosis.¹⁹

Oral candidiasis appears in one of two forms: white or erythematous. White oral candidiasis is characterized by white lesions, such as pseudomembranous candidiasis and hyperplastic candidiasis. Erythematous oral candidiasis is characterized by red lesions, such as acute/chronic atrophic candidiasis, median rhomboid glossitis, angular cheilitis, and linear gingival erythema.²⁰

Oral candidiasis in PLHIV needs to be treated not only because of the discomfort of the patient, but also because the foci can act as a reservoir for spread to other organs, especially the esophagus. In patients with severe immunodeficiency, it is necessary to prevent colonization and infection, because the oropharynx can be a major source of initial colonization and allow further spread of infection.¹⁷ Candidiasis can develop into a systemic infection through the lymph flow that attacks vital organs such as the kidneys, lungs, brain, and blood vessel walls which is fatal.²¹

Antifungal Drugs: Azole Systemic Fluconazole

Fluconazole is the most commonly used antifungal agent in the treatment of oral candidiasis in HIV patients.^{7,16} Kidneys are the main site for fluconazole to be metabolized and excreted. Fluconazole can be taken on day 1 as an initial dose of 200 mg, and for later doses daily for 7 to 14 days in 50 mg, 100 mg, 150 mg, 200 mg, or 3 mg /day.²⁰ Recently, a single-dose fluconazole regimen of 750 mg and fluconazole gel in situ are as effective as the standard 14 days regimen in achieving clinical and mycological cures in the treatment of oral candidiasis in PLHIV¹⁶. Mild side effects of fluconazole drugs such as headaches and gastrointestinal disturbances.²⁰

Itraconazole

Useful for targeting fluconazole-resistant candida strains, including *Candida glabrata* and *Candida krusei*. The liver is the site for itraconazole to be metabolized. Patients are instructed to take the drug with acidic foods and drinks to enhance absorption since itraconazole capsules require an acidic pH for absorption. Itraconazole capsules should be taken at a dose of 100 / 200 mg daily for 14 days. Itraconazole at a dose of 200 mg is given three times daily for 3 days if the patient has severe disease. Side effects of itraconazole such as headache, dizziness, liver dysfunction, hypokalemia, and gastrointestinal disturbances.²⁰

Posaconazole

The latest triazole that has been approved for the treatment of cases of acute oral and/or esophageal candidiasis and azole refractory in PLHIV is posaconazole. The liver is the site for posaconazole to be metabolized. Relapse was less common in the Posaconazole group.¹⁶ Posaconazole is used for fluconazole-resistant strains of candida. Posaconazole suspension is prescribed on day 1 as an initial dose of 100 mg twice daily, and then for 13 days at a dose of 100 mg daily. For refractory cases, posaconazole may be given as an initial dose of 400 mg twice daily for 3 days, then 400 mg once or twice daily for 25 to 28 days. Side effects of posaconazole such as neutropenia and gastrointestinal disturbances.²⁰

Ketoconazole

Ketoconazole is an antifungal agent and is part of the azole imidazole category of drugs. This drug is fungistatic and can inhibit the cytochrome P450 pathway, this drug can also inhibit the 14-demethylation of lanosterol thus preventing the formation of ergosterol in fungal cell membranes.¹⁶ Ketoconazole 200 mg can be used once or twice daily for 2 weeks for oral candidiasis. The most common side effects of oral ketoconazole are gastrointestinal, such as vomiting and nausea. Avoid giving to pregnant

women or women planning to become pregnant, with proton pump inhibitors, antihistamine the possible effect on male fertility by decreasing agents, or antacids may decrease ketoconazole nephrotoxicity, hair loss, hepatotoxicity, and absorption.² testosterone production. Combination therapy

RESULT

Table 1. The results of the search case report and original research.^{7,15,22-28}

No	Author	Type of Article	Type of Oral Candidiasis	Management	Antifungal Drug	Treatment Result
1	Riyanto et al., 2020 ⁷	Case Report	pseudomembranous candidiasis	First visit 1. oral health care 2. mouthwash 0,2% chlorhexidin gluconate 3. CIE Second visit 4. fluconazole 100mg/day intravenously Third visit 5. taken two kinds of ARV 6. fluconazole tablet	fluconazole	Patient stated that there were no more white plaques in his mouth and did not breathless. The pseudomembranous candidiasis had healed and treatment was complete.
2	Hapid et al., 2023 ²²	Case Report	pseudomembranous oral candidiasis	First visit 1. education and oral hygiene instruction 2. nystatin oral suspension 4 times 2 mL per day by swishing for a minute before spit Second visit 3. discontinue nystatin □ replaced with fluconazole 4. chlorhexidine gluconate mouthwash 0.2% of 10 mL swish and spit three times a day Third visit 5. apply a thin layer of Vaseline album on the upper and lower lips	fluconazole	White plaque that covers the patient's tongue were resolved completely and without any shortness of breath
3	Usman et al., 2017 ¹⁵	Case Report	pseudomembranous oral candidiasis	First visit 1. fluconazole 150 mg tablet once a day for 7 days 2. mouthwash 0,1% chlorhexidin gluconate with a dose of 3x a day each time as much as 10 ml 3. CIE Second and Third visit	fluconazole	The patient is feeling better and there are no complaints on the tongue. On the dorsum of the tongue, a white pseudomembrane is visible, it can be scraped off without pain,

				4. Continuing the previous drug prescription Fourth visit 5. The patient has been taking ARVs (nevirapine, lamivudine, and tenofovir at a dose of 1x1)		diffuse borders, irregular edges. For the oral cavity, the patient is instructed to maintain oral hygiene, namely cleaning the tongue
4	Murtiastuti k et al., 2020 ²³	Case Report	Acute pseudomembranous candidiasis	First visit 1. fluconazole of 150 mg/day 2. duviral of 1 tablet/day (300 mg zidovudine and 150 mg lamivudine) 3. multivitamin B complex and iron 1 tablet/day 4. educated to oral hygiene Second visit 5. resistance test: fluconazole, ketoconazole, and nystatin Third visit 6. suspension of nystatin, three times a day as much as 5 ml (500,000) for fourteen days 7. multivitamin B complex and iron 1 tablet/ day	nystatin	On the sixth day of treatment (used nystatin), the pseudomembrane began to thin out. On the tenth day of treatment (used nystatin), the pseudomembrane disappeared. On the fourteenth day, no sign of complications or recurrence was found.
5	Ding et al., 2022 ²⁴	Case Report	oral candidiasis	First visit 1. ART was continued with lamivudine and dolutegravir Second visit 2. fluconazole injection as an antifungal treatment 3. sodium bicarbonate gargle	fluconazole	Three consecutive days of examination showed negative results. The patient was discharged
6	Ramadurai et al., 2019 ²⁵	Case Report	chronic hyperplastic candidiasis, atrophic candidiasis, and pseudomembranous candidiasis	First visit 1. Topical clotrimazole 1% thrice daily over the affected tissues Second, Third, and Fourth follow up 2. Topical clotrimazole 1% thrice daily over the affected tissues. 3. HAART	clotrimazole	Three months follow up: Relapse of all the lesions
7	Rosa and Sufiawati, 2023 ²⁶	Case Report	chronic atrophic candidiasis and	First visit 1. Patient was referred to Internal Medicine	-	Three weeks later, on the second visit, all lesions were completely healed

			angular cheilitis			
8	Mushi et al., 2021 ²⁷	Original Research	oral candidiasis	Compare Agents 1. Fluconazole 2. Voriconazole 3. Posaconazole 4. Caspofungin 5. Micafungin 6. 5-Fluorocytosine	fluconazole	Most isolates were highly susceptible to commonly used antifungal agents like fluconazole.
9	Kirti, 2019 ²⁸	Original Article	Oral candidiasis (Acute pseudomembranous candidiasis, Chronic hyperplastic candidiasis, Acute atrophic candidiasis)	Treatment procedures 1. patients already receiving HAART 2. clotrimazole mouth paint & chlorhexidine mouthwash 3. in severe or persistent cases oral fluconazole tablet was added for 14 days	Clotrimazole & fluconazole	There is a definite correlation between falling CD4 count and the prevalence of oral candidiasis. Eminent fall in CD4+ cell count can be anticipated in view of the clinical presentation, and timely HAART can be started, before further worsening takes place.

DISCUSSION

Oral candidiasis can be treated either topically or systemically. Treatment should be maintained for 7 days. Response to treatment is often good, oral lesions and symptoms may resolve in a fairly short time (ranging from 2 to 5 days), but relapse is common due to immunodeficiency in the patient.¹⁹ Before undergoing treatment, patients who have just found out that they are infected with HIV/AIDS need to go through many laboratory tests, including routine blood tests to determine their hematologic condition, because many studies report that hematology disorders are often found in PLHIV.¹³

Management of patients with oral candidiasis is by eliminating predisposing factors, improving oral hygiene, and administering antifungal drugs such as topical agents (*Gentian violet*, *nystatin*, and *amphotericin B*) and/or systemic triazoles

(Fluconazole, Itraconazole, Posaconazole, and Ketoconazole).¹⁷

Management of oral candidiasis in PLHIV are eliminating predisposing factors, such as smoking and hyposalivation should be addressed first. Improving oral hygiene and stopping habits that can worsen the patient's oral hygiene are also needed.¹⁷ Oral hygiene involves cleaning the teeth, buccal cavity, tongue, and dentures, if present, daily.²⁹

Administration of antifungal drugs for oral candidiasis. In cases of oral candidiasis associated with immunodeficient individuals, topical agents may not be effective in such cases, hence systemic triazole administration is necessary.³⁰ Oral candidiasis in HIV patients is less responsive to polyene antifungal drugs (*nystatin* and *amphotericin B*), so the most common indication for the administration of antifungal drugs is azole systemic drugs.¹⁷ Fluconazole is a triazole antifungal agent that is widely used for the treatment of *Candida* spp. Infection.^{7,15,16} Azole antifungal drugs are

fungistatic and work by inhibiting fungal ergosterol synthesis resulting in defects in the fungal membrane.¹⁵

Administration of 0.2% chlorhexidine gluconate mouthwash to HIV patients is also useful as an antiseptic effect which has broad-spectrum antibacterial properties and at the same time has an antifungal effect to control Candida colonies, besides that the alcohol content in this mouthwash also functions as an astringent.^{15,22} These topical bactericidal properties also prevent secondary infection which is objective in healing oral lesion.²²

The management of oral candidiasis as well as all secondary/opportunistic infections in patients with HIV/AIDS must involve other fields in the management of HIV/AIDS and antiretroviral therapy (ARV).¹⁵ ARV is part of HIV/AIDS treatment to reduce the risk of transmission, inhibit worsening conditions due to opportunistic infections, reduction of oral lesions, and improve the quality of life of PLHIV.^{7,14} Non-nucleoside reverse transcriptase inhibitors (NNRTIs) appear to be most effective in reducing candidiasis by consistently following current therapy guidelines that recommend NNRTI-based therapy as the treatment of choice for initial ARVs¹⁷. If HIV can be suppressed properly, opportunistic infections can also be treated adequately.¹⁵

CONCLUSION

Management of oral candidiasis in PLHIV sufferers are eliminating predisposing factors, improving oral hygiene and stopping habits that can worsen the patient's oral hygiene, administration fluconazole antifungal drugs, giving chlorhexidine gluconate mouthwash, and antiretroviral (ARV) treatment.

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Oral Manifestation of Papillon-Lefevre in Two Siblings

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Online submission : 27 May 2022

Accept Submission : 04 July 2023

ABSTRACT

Background: Papillon-Lefèvre Syndrome (PLS) is a very rare genetic disorder (autosomal recessive) that usually affects infants between the ages of one and five years. PLS is characterized by palmar-plantar hyperkeratosis and premature loss of primary and permanent teeth with extensive, severe, and rapid destruction of the alveolar bone, leading to the premature loss of both teeth. **Objective:** To report on the management of PLS patients. **Case:** A 9-year-old girl and a 2.5-year-old boy from Nganjukto General Hospital, Pediatric Dentistry Division, RSGM Airlangga University with the main complaints of upper left tooth pain, rocking, difficulty eating, erythematous hyperkeratosis hands and feet, periodontal inflammation, mobility. bad teeth. **Case Management:** Nine-year-old girl: Teeth #26 and #46 could not be retained and extracted due to buccoversion and severe mobility. Periodontal supportive therapy was periodontal debridement, scaling and root planing and oral hygiene counseling with 0.20% chlorhexidine gluconate. Two-and-a-half-year-old boy: Too young, he is observed every 3 months. It is recommended to take vitamin B complex in appropriate doses and fruit juice as an additional supplement. **Conclusion:** Intensive periodontal treatment and administration of antibiotics only delays the progression of periodontal disease and cannot be used to prevent primary and permanent teeth. Extensive and repeated prosthodontic treatment is required to provide functional teeth to children during their period of jaw growth.

Keywords: Aggressive Periodontitis, Papillon-Lefèvre Syndrome, Palmar-plantar Hyperkeratosis, Siblings

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INTRODUCTION

Papillon and Lefèvre are doctors from France who first introduced Papillon-Lefèvre Syndrome (PLS) in 1924.^{1,2,3} Diffuse or localized hyperkeratosis of the palms and soles (palmar-plantar hyperkeratosis) is the hallmark of this syndrome. These signs are always associated with generalized aggressive periodontitis, and are recognized by the presence of severe inflammation and degeneration of the structures surrounding and supporting the teeth (periodontium).^{4,5,6}

Papillon-Lefèvre Syndrome (PLS) is a rare autosomal recessive disorder. The syndrome is believed to affect one to four individuals per million.¹ An increased prevalence was observed in the offspring of relatives; Kinship between parents was documented in one third of the cases studied. The predominance of race in the case of Papillon-Lefèvre Syndrome is absent and for the sexes males and females are equally affected in this regard. Previous research has shown that Papillon-Lefèvre Syndrome can increase susceptibility to infection in about 20% of cases. There are no scientifically based reports that show a decrease in life expectancy in individuals diagnosed with this disease.⁷

Primary teeth in children often experience loose and fall out. However, if the permanent teeth are not treated, they will decay and even fall out.^{7,8} Other signs and symptoms of this syndrome include frequent pyogenic skin infections, nail dystrophy, and hyperhidrosis. Parents with very close ancestry are shown in between 20% and 40% of cases. Patients usually have principal disease associated with functional or quantitative neutrophil abnormalities, and are 50% immunocompromised. Patients with PLS appear to have a particular predisposition to develop a pyogenic liver abscess. Pyogenic liver abscess is an uncommon feature.^{4,9}

A recently discovered genetic abnormality in PLS has been mapped to

chromosome 11q14-q21 involving a cathepsin C mutation. Studies show more than 90% of PLS patients have reduced cathepsin C activity.^{3,10,11} Impaired chemotactic and phagocytic functions of polymorphonuclear leukocytes (PMNs) have been described in many reports. In contrast to the above studies, however, PMN chemotaxis reported normal. Several reports also discuss lymphocyte function in PLS patients.¹²

The effects on the periodontium appear immediately after tooth eruption, as the gingiva becomes erythematous and edematous.⁵ Plaque accumulation in deep fissures and halitosis may occur. The primary incisors are the most affected teeth first and can show marked mobility, especially by the age of 3 years. By 4 or 5 years of age, all of the primary teeth may have changed. Most teeth fall out at the age of 14-15 years. Damage to the alveolar bone often results in jaw atrophy. In such cases the patient is often edentulous at an early age. This paper presents a brief overview of two patients' siblings related with Papillon-Lefèvre syndrome and describes the clinical presentations in a case with typical dental and dermatological findings. PLS frustrates patients psychologically, socially, and aesthetically, and its management is challenging and the management of cases with PLS requires a multidisciplinary approach with the active participation of the dental surgeon, dermatologist, and pediatrician.

CASE

There were two patients from General Hospital of Nganjukto Pediatric Dentistry Department, Universitas Airlangga Dental Hospital. Nine years old girl and two and half-years old boy with chief complaint of tooth ache on the upper left and loose, also difficulty in eating. No family members, other relatives, or even the patient's parents showed similar manifestations. The skin lesions started to appear after two and half years of age. There was no history of other serious illness or



susceptibility to infection in areas other than the oral cavity.

Dental history revealed eruption of primary teeth in normal chronological order. The girl was around three years old; the gingiva was red, swollen, and painful. Furthermore, the teeth become mobile and exfoliated. The girl was edentulous by the age of three and half years. Intraoral examination showed generalized severe periodontitis manifested by redness of gingiva, generalized inflammatory gingival enlargement. Deep periodontal pockets (>6 mm) were present around all permanent teeth. There are moving, drifting (buccoversion), and extruded teeth. The patient has difficulty chewing and severe halitosis. Tooth size in normal shape and size (figure 1,2).

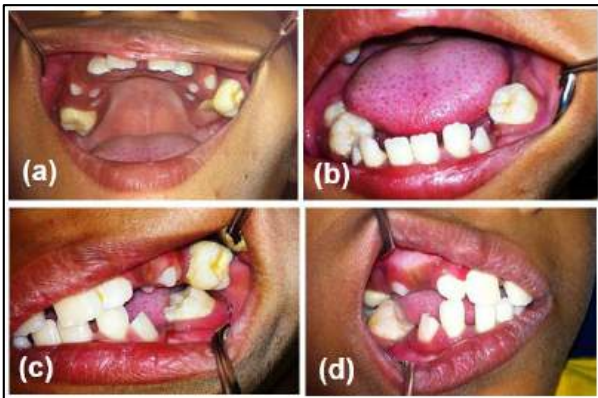


Figure 1. Intraoral examination with severe gingival inflammation in a girl. a) Pre-operative examination of the upper jaw. b) Pre-operative examination of the lower jaw. c) Occlusion in the left lateral view. d) Occlusion in right lateral view.



Figure 2. Intraoral examination with severe gingival inflammation in a boy. a) Pre-operative examination of the upper jaw. b) Pre-operative examination of the lower jaw.

Dermatological examination showed hyperkeratosis of palms and soles in the form of well-demarcated plaques. The hyperkeratosis was exacerbated during the winter months (figure 3,4). Radiographic examination revealed a severe alveolar bone loss of all erupted teeth with less than one third of alveolar bone remaining giving the teeth a “floating in air” (figure 5).



Figure 3. Palmar-Plantar Hyperkeratosis in a girl. a) Palmar surface of Hand. b) Front view of Leg. c) Dorsal surface of Foot. d) Plantar surface of Foot.

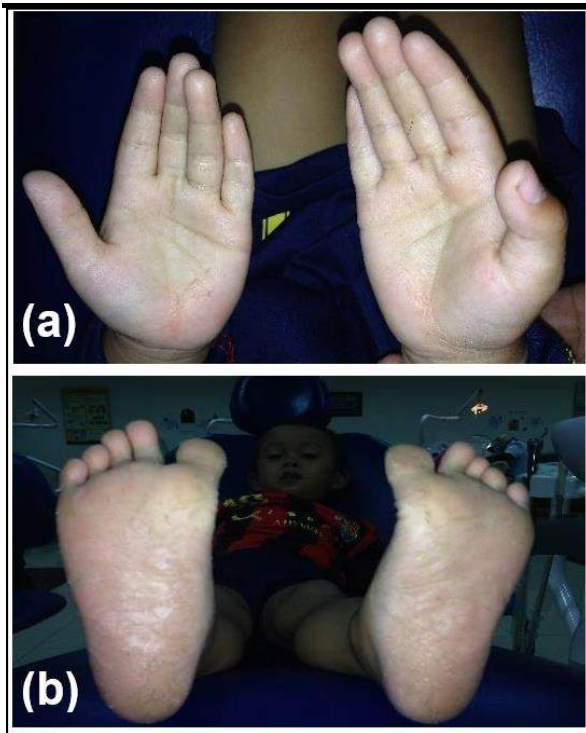


Figure 4. Palmar-Plantar Hyperkeratosis in a boy. a) Palmar surface. b) Plantar surface.



Figure 5. Radiographic Examination

CASE MANAGEMENT

In the history of the two siblings there was no systemic problem, but palmar-plantar hyperkeratosis was observed. All the primary dentition molars were lost early in both upper and lower jaw (figure 6). In addition to third degree mobility, alveolar bone loss, severe gingivitis and plaques, in the light of these findings Papillon-Lefèvre Syndrome was diagnosed in both patients. First, the two siblings, 9-year-old girl and a 2.5-year-old was prescribed an antibiotic of amoxicillin (250 mg, 2x1, one week) and metronidazole (250 mg, 2x1,

one week) and a mouth rinse of 0,2% chlorhexidine gluconate (2x1, one week), and educated for oral hygiene. Vitamin C and B complex is further prescribed. Her mother gave some fruit juice at home, such as tomato, avocado, orange, etc.

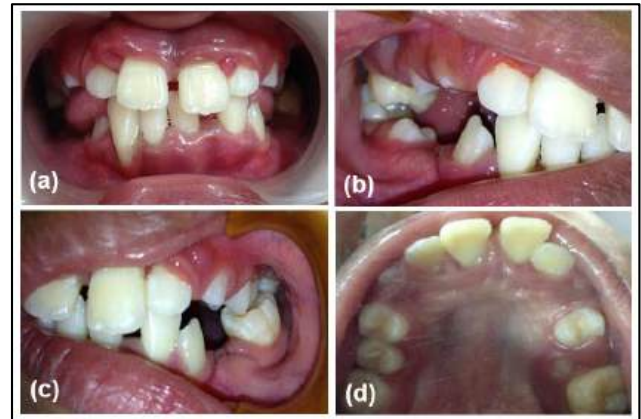


Figure 6. Intraoral Examination Observation. a) Occlusion in front view. b) Occlusion in right lateral view. c) Occlusion in left lateral view. d) Upper jaw view.

Another treatment for the palmar-plantar hyperkeratosis to minimize the effect and appearance of scales on the skin of the patient, suggested using Kloderma or olive oil after taking a bath, based on consultation with Dermatologist (Figure 7). The radiographic examination after #26 and #46 were extracted because of its buccoversion and severe mobility (Figure 8). The boy was too young, so he was observed every 3 months. Panoramic for the boy is unavailable because of cooperative issues.

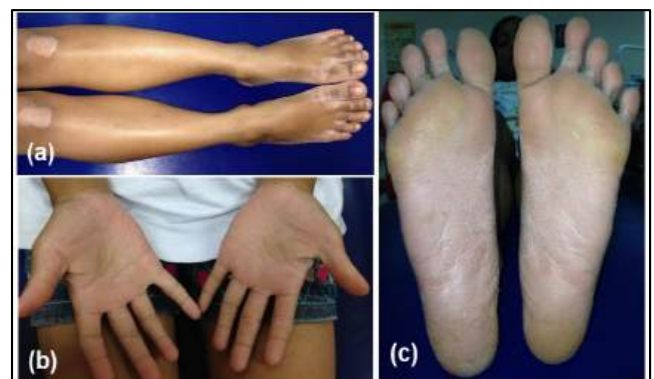


Figure 7. Palmar-Plantar Hyperkeratosis after Treatment. a) Front view of Leg. b) Palmar surface. c) Plantar surface.



Figure 8. Radiographic after five months.

DISCUSSION

Papillon-Lefèvre Syndrome is an inherited autosomal recessive disorder.^{13,14,15} Typically the parents are not affected and there is no family history of the disease. Higher prevalence has been reported when parental consanguinity is involved, but no predilection for gender or race has been documented. The patient in this case report was a female, her parents were not consanguineously related, and the disease affected none of her siblings.¹⁶

The clinical features of PLS include palmar-plantar hyperkeratosis and generalized, rapidly progressive periodontitis accompanied by severe alveolar bone destruction, leading to early loss of both primary and permanent dentitions,^{16,17} also hyperkeratosis of the palms, soles, elbows and knees, and severe periodontitis, which resulted in loss of the primary and permanent teeth as a clinical manifestations in patient.¹⁸

Because the etiology and pathogenesis of PLS periodontitis is directly related to high levels of *Aggregatibacter actinomycetemcomitans*, the use of an antibiotic that acts specifically on this pathogen has been claimed to be important for a successful treatment plan.¹⁶ Historically, the treatment of Papillon-Lefèvre Syndrome was by extracting all primary teeth and replacing them with complete dentures.⁴ More recently, several studies have investigated the effectiveness of this therapy

with different antibiotics that combined with conventional periodontal treatment, would prevent or delay the loss of permanent teeth.¹⁹ The findings of recent studies have shown that *Aggregatibacter actinomycetemcomitans* was effective with amoxicillin/metronidazole and may be included in the therapeutic protocol of individual with Papillon-Lefèvre Syndrome.³ Although there is a clear association between the presence of *Aggregatibacter actinomycetemcomitans* and the Papillon-Lefèvre Syndrome, there is no evidence of cause and effect. In almost all cases of PLS, the patients have lost their teeth by the age of 13, irrespective of the treatment provided.²⁰

Other author has recommended the elimination of periodontal pathogenic flora through premature extraction of all primary teeth combined with antibiotic coverage in a try and limit the possibility of contamination of the unerupted permanent dentition.¹⁶ They claim that if the permanent teeth erupt in oral surroundings free from periodontal ailment, it is probable that they are able to remain periodontally wholesome for an extended length. If the patient has been identified with PLS prior to the eruption of the permanent dentition, this therapy may be attempted because of the treatment of desire. Selecting the ideal treatment is not as clear-cut when the patient seeks dental care in the mixed dentition stage or later. In these patients, the treatment plan may include either extraction of all erupted teeth followed by a period of antibiotic coverage or extraction of only the hopelessly affected teeth combined with periodontal therapy for the remaining teeth with antibiotic coverage.¹⁶

Progressing periodontal disorder main to tooth loss is a first-rate trauma in this patient. Extensive and repeated prosthodontic treatment may additionally become necessary to offer the kids with a functional dentition at some stage in the growth length in their jaws. Edentulousness and location of complete dentures that want to be renewed at quick intervals is a similarly unappealing option. Suggestions for further

examination are to always monitor the balance of occlusion, balance the strength of mastication, and take vitamins to boost the immune system. In this case, a toxicological method is needed to determine the concentration of heavy metals in human hair and nails, such as Hg, Cu, Ni, Pb, Co, and Cd. Extensive and repeated prosthodontic treatment is required to provide functional teeth to children during their period of jaw growth.

CONCLUSION

The combination of intensive periodontal treatment and administration of antibiotics only temporarily delays the progression of periodontal disease and cannot be used as a means of preventing the loss of primary and permanent teeth. The results of this case report indicate that the management of periodontitis in PLS patients becomes more complicated when the initial periodontitis occurs in the mixed dentition. In this situation, control of the progression of periodontal decay can be accomplished and the minimization of tooth loss is greatly improved.

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Relation Between Parents' Education and Residence with Knowledge and Attitude on Children Oral Health

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Online submission : 21 September 2022

Accept Submission : 11 November 2022

ABSTRACT

Background: Parents' knowledge and attitude on children oral health will form their childrens' underlying behaviour which will either support or not their children's oral health. **Objective:** To know whether there parents' level of education and residence (coastal vs urban areas) are related with their knowledge and attitude regarding the oral health of children age 3-6 years old. **Materials and Methods:** This research is a cross sectional study using survey. The samples that were studied were 41 parents of 3-6 years old children in PG/ TK Benih Kasih Surabaya and 41 parents of 3-6 years old children in TK/ PAUD Benih Prima Batam. The method of collecting data is by non-experimental survey. Statistical analysis on the relationship between variable was performed using Spearman Rank Correlation. **Results:** The research showed that level of education has a positive relationship with knowledge and this relationship goes both ways. Level of education also has positive relationship with attitude and vice versa. On the other hand, residence has insignificant relationship with knowledge. Meanwhile, residence has negative relationship with attitude. **Conclusion:** The higher the level of education of parents relates to higher level of knowledge and attitude regarding the oral health of children and vice versa. Meanwhile the residence, whether coastal area of Batam or urban area of Surabaya, has no relationship with the knowledge. Parents in urban area of Surabaya, on the other hand, has significant relationship with positive attitude toward children's oral health, and this relationship goes both ways.

Keywords: Knowledge, Attitude, Level of Education, Coastal Area, Urban Area

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INTRODUCTION

Awareness on the attitude of maintaining one's own oral and dental hygiene is the most important thing in maintaining dental and oral hygiene.¹ 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.² Parental knowledge and attitudes is very important in underpinning the formation of attitudes that support or do not support children's dental and oral hygiene, because children's attitudes will reflect the attitudes of their parents.^{3,4} If parents do not pay attention to their attitude in dental and oral health care, children who still have the habit of imitating their parents' attitudes will be very vulnerable to dental and oral diseases due to poor self-habits in maintaining oral hygiene and health.⁵ During this period, dental diseases such as caries are still often ignored by many parents who think that tooth decay is a common thing in children who will replace the primary teeth with permanent teeth.⁶ Whereas when caries is not treated, children will experience pain, discomfort, disability, acute to chronic infections, disturbances in eating and sleeping and can allow treatment in hospital which causes high medical costs and reduced learning time in school.⁷

The results of the 2018 Basic Health Research or Riskesdas stated that 93% were children at an early age, namely in the age range of 5-6 years, experience cavities. Preschooler experience the process of caries formation due to the lack of attention of parents to food daily and brushing teeth. At the age of 3-5 years, the child starts doing something based on his wishes one of them started trying various flavors of food in any form so that it can have a bad impact on the teeth if the child they did not pay attention to the solution to prevent caries.⁸ This shows that there is a disturbance in the quality of life of

school children in Indonesia which results from the lack of preventive measures by parents at an early age in order to avoid cases of tooth decay in children in the future.⁹ The low encouragement from parents can cause children's teeth cleaning activities to be less than optimal because what children see, they will imitate and when parents do not set good examples, children will also not pay attention when parents give orders to clean teeth.¹⁰ Efforts to take care of children's teeth at an early age still really need parents who can encourage their children to provide directions for caring for dental and oral health properly and correctly because children's knowledge about dental and oral health is still lacking compared to adults.¹¹ Therefore, awareness from parents is needed to educate their children from an early age about dental and oral care in order to avoid impaired function, activity, and decreased work productivity that will affect the quality of life¹. In children aged 1-7 years, the teeth that grow are deciduous teeth which will be replaced with permanent teeth, but children must be exposed to dental health care as early as possible so that dental problems are not more complicated and more expensive to treat when the teeth are mature grow.²

Differences between urban and coastal areas can be seen in terms of education, economy, technology, culture, and consumption patterns which are very different in coastal and urban areas.¹² This is also reinforced by the results of the Basic Health Research (RISKESDAS) which also shows data in 2013 that the percentage of children who have dental and oral problems in coastal areas is 23.2% and in urban areas is 25.9%. The percentage of children receiving dental health care in coastal areas is 8.1% and in urban areas is 31.1%.¹³ This shows that although the percentage of children who have dental and oral problems in coastal areas is less than in urban areas, the percentage of children receiving dental health care in coastal areas is much lower than in urban areas. In terms of the level of education, coastal

areas have a fairly low level of education, which is generally only elementary school graduates, while in urban areas the level of education is up to advanced level, namely graduating from high school and graduating from college.¹⁴ On the economic side, most of the people living in coastal areas have a livelihood as a fisherman and people living in urban areas have a livelihood as an employee or office worker. In terms of technology, understanding of technology in coastal areas is still relatively simple and traditional, while in urban areas it is classified as advanced and modern.¹⁵ In addition, on the cultural side, coastal communities are still very strong and apply their cultural traditions more in their daily lives, while urban communities tend to be more open to new knowledge and teachings so that culture is no longer the only reference in their daily lives.¹⁶ In terms of consumption, caries prevention can be overcome by increasing the use of fluoride which is obtained from the food and drinks we consume every day. The presence of fluoride contained in marine fish which is the daily food of people in coastal areas is thought to reduce the number of caries incidence.¹⁷

Surabaya is chosen as an urban area representative due to well known fact that it is the second biggest city in Indonesia with a good health related performance. The city's performance is supported by East Java Health Office which monitor health status especially amongst the children. On the other hand, Batam is chosen due to the coastal aspect and recently it has rather mediocre health related performance. For instance, the Batu Aji Health Center nutrition report in 2016, indicated that Batam is lacking in term of children health monitoring performance.¹⁸

This study aims to determine whether there is a relationship between the level of education of parents and the place of residence of parents on the coast (Batam) and in urban areas (Surabaya) with knowledge and attitudes related to dental health of children aged 3-6 years.

MATERIALS AND METHODS

This study is a cross sectional study using a survey as the method of collecting data. The samples studied were 41 parents of children aged 3-6 years at PG/TK Benih Kasih Surabaya and 41 parents of children aged 3-6 years TK/PAUD Benih Prima Batam and who are still actively attending the school in 2020 with a purposive sampling technique.

Google Form was used for the online data collection online which was carried out for approximately two weeks in October 2020. Statistical analysis was carried out using the Spearman Rank Correlation and this particular test took place in August 2022, is a continuation of the previous research. The research's data is ordinal or ranked in nature hence the Spearman correlation is used instead of Pearson's correlation coefficient. This approach is chosen to test the relationship between variables which may not have linear relationship. The level of education in particular is level or ranked data and Spearman correlation is perceived to be more suited to test its relationship with knowledge and attitude toward children oral health variables.

The level of education variable is measured by five level of education which are (1) elementary, (2) junior high school, (3) high school, (4) university bachelor, and (5) university master. The residence variable is measured using dummy variable where 0 represent urban area (Surabaya) and 1 represent coastal area (Batam). The knowledge variables is measured using 10 likert scale questions to assess the level of parents knowledge on children oral health. The attitude variable is measured using 10 likert scale question also and these questions is set to assess the attitude toward children oral health. These questions is detailed further in Appendix 1.

RESULTS

General Data of Respondents

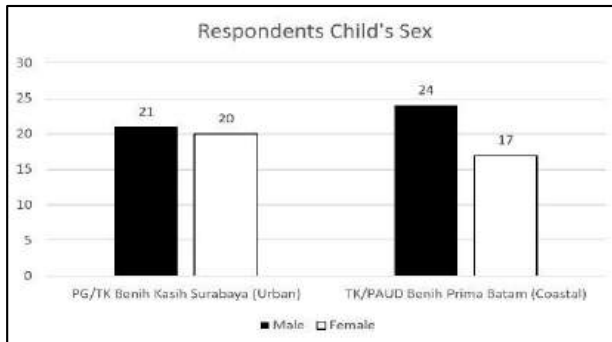


Figure 1. Frequency distribution of respondents' child in PG/TK Benih Kasih Surabaya (Urban Area) and TK/PAUD Benih Prima Batam (Coastal Area) by gender.

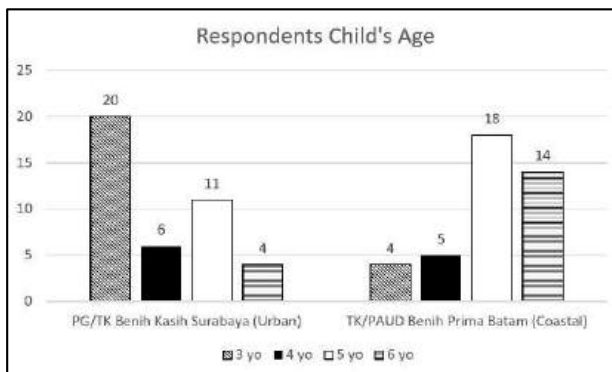


Figure 2. Frequency distribution of respondent child in PG/TK Benih Kasih Surabaya (Urban Area) and TK/PAUD Benih Prima Batam (Coastal Area) based on the age of the child.

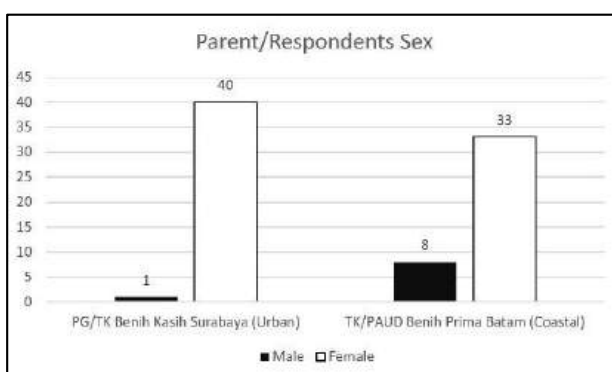


Figure 3. Frequency distribution of parental respondents in PG/TK Benih Kasih Surabaya (Urban Area) and TK/PAUD Benih Prima Batam (Coastal Area) based on the gender of the parents.

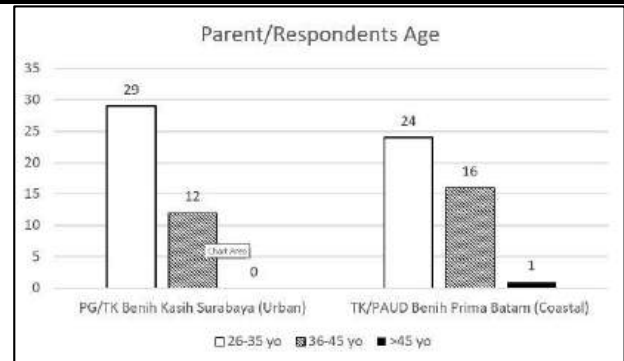


Figure 4. Frequency distribution of parental respondents in PG/TK Benih Kasih Surabaya (Urban Area) and TK/PAUD Benih Prima Batam (Coastal Area) based on the age of the parents.

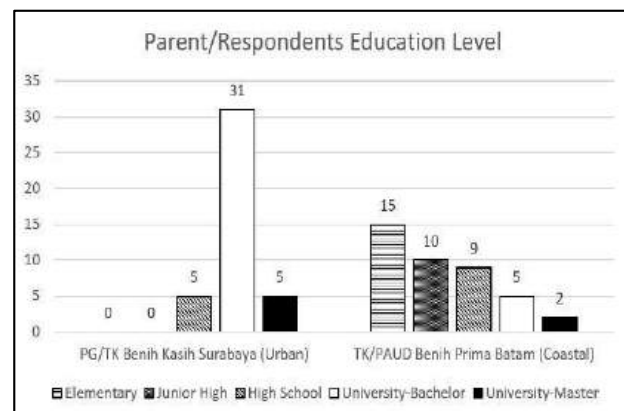


Figure 5. Frequency distribution of parental respondents in PG/TK Benih Kasih Surabaya (Urban Area) and TK/PAUD Benih Prima Batam (Coastal Area) based on the education level of parents.

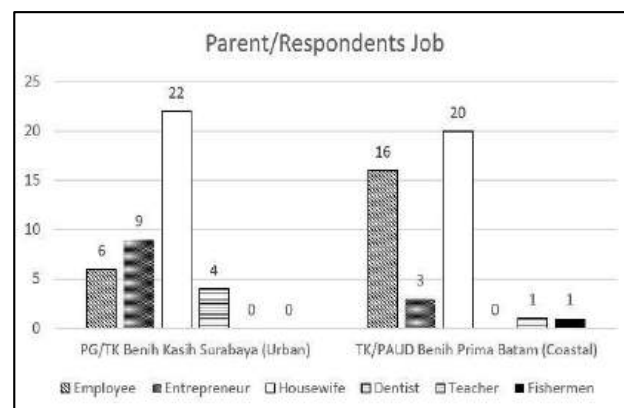


Figure 6. Frequency distribution of parental respondents in PG/TK Benih Kasih Surabaya (Urban Area) and TK/PAUD Benih Prima Batam (Coastal Area) based on parental occupation.

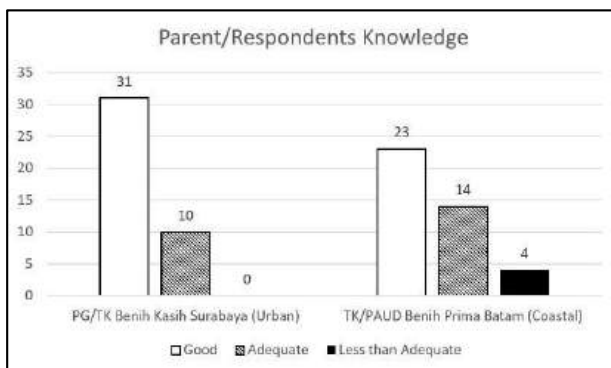
Specific Data for Respondents

Figure 7. Parents' level of knowledge about children's dental and oral health in PG/TK Benih Kasih Surabaya (Urban Area) and TK/PAUD Benih Prima Batam (Coastal Area)

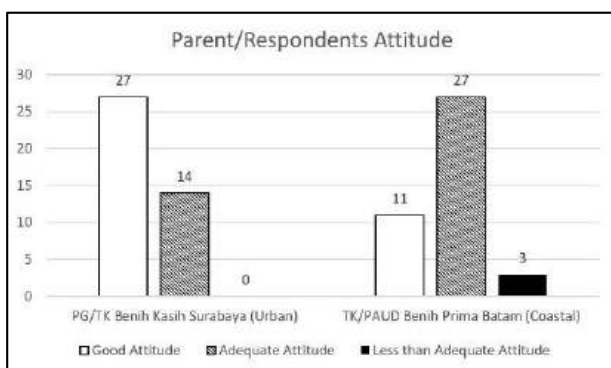


Figure 8. The level of parental attitudes about children's dental and oral health in PG/TK Benih Kasih Surabaya (Urban Area) and TK/PAUD Benih Prima Batam (Coastal Area)

The Results of the Validity and Reliability of the Questionnaire

Testing the validity of this research instrument using the Pearson product moment correlation index, where the question items that have an r value greater than 0.3 are declared valid. Testing the reliability of this research instrument using Cronbach's alpha coefficient where the alpha value is equal to or greater than 0.6 indicates a fairly consistent measurement result. The validity and reliability tests of financial instruments are described in the following sections.

Table 1. Test the validity and reliability of the Knowledge variable (P)

Group	Item Number	Validity		Coefficient Alpha
		Correlation (r)	Probability (p)	
Knowledge	Knowledge 1	0.314**	0.005	0.612
	Knowledge 2	0.345**	0.001	
	Knowledge 3	0.659**	0.000	
	Knowledge 4	0.450**	0.000	
	Knowledge 5	0.708**	0.000	
	Knowledge 6	0.676**	0.000	
	Knowledge 7	0.151	0.177	
	Knowledge 8	0.151	0.177	
	Knowledge 9	0.395**	0.000	
	Knowledge 10	0.477**	0.000	

Source: Questionnaire primary data (processed), August 2022.

Based on the data from table 1 above, it shows that all question items for the knowledge variable have a Pearson product moment correlation index value (r) which is greater than 0.3 except for the knowledge 7 and knowledge 8 question items (with an r of 0.151). Knowledge question items 7 and 8 were omitted from the test to ensure the validity of all knowledge variable question items. The knowledge variable question items have a Cronbach alpha coefficient of 0.612 which means that all question items for the knowledge variable (P) are reliable for the next test.

Table 2. Test the validity and reliability of the Attitude variable (S)

Group	Item Number	Validity		Coefficient Alpha
		Correlation (r)	Probability (p)	
Attitude	Attitude 1	0.644**	0.000	0.664
	Attitude 2	0.489**	0.000	
	Attitude 3	0.473**	0.000	
	Attitude 4	0.618**	0.000	
	Attitude 5	0.404**	0.000	
	Attitude 6	0.276	0.012	
	Attitude 7	0.615**	0.000	
	Attitude 8	0.397**	0.000	
	Attitude 9	0.744**	0.000	
	Attitude 10	0.393**	0.000	

Source: Questionnaire primary data (processed), August 2022

Based on the data from table 2 above, it shows that all question items for the attitude variable have a Pearson product moment correlation index value (r) which is greater than 0.3 except for the attitude question item 6 (with an r of 0.276). Attitude question items 6 were omitted from the test to ensure the validity of all attitude variable question items. The attitude variable question items have a Cronbach alpha coefficient of 0.664, which means that all question items for the attitude variable (S) are reliable for the next test.

Relationship Test Results

To determine whether this relationship test uses the Pearson Product Moment Correlation or Spearman Rank Correlation, a normality test is required:

Table 3. Normality Test for

Variables	Kolmogorov Smirnov Sig	Shapiro Wilk Sig
Knowledge	0.000	0.000
Attitude	0.000	0.000

Source: Questionnaire primary data (processed), August 2022

Significant values in table 3, both Kolmogorov Smirnov and Shapiro Wilk columns reveal that all the variables tested are distributed abnormal, with a sig below 0.05. The results of this normality test suggest that the relationship test in this study uses the Spearman Rank Correlation.

Testing the relationship in this study using the Spearman Rank correlation coefficient by looking at the probability (sign) between the education level of parents with Knowledge (P) and Attitude (S). The following is a summary of the relationship test:

Table 4. Relationship Test

Relationship of Parents' Education Level with	Spearman's rho	
	Correlation Coefficient	Sig.(2 tailed)
Knowledge	0.384	0.000
Attitude	0.711	0.000
Relationship between Parent's Residence and		
Knowledge	0.140	0.208
Attitude	-0.433	0.000

Source: Primary data questionnaire (processed), August 2022

Relationship between Parents' Education Level and Knowledge

The correlation coefficient value between parents' education level and knowledge in Table 4 is 0.384 with probability (sign) of 0.000. The probability value which is smaller than 0.01 indicates that there is a significant relationship between parents' education level and knowledge, and the relationship between the two is positive with a correlation coefficient of 0.384. Alternative hypothesis H_{11} : accepted at 1% alpha level. Furthermore, this also means that if there is an increase in the education level of parents, then there is a tendency to increase knowledge and this relationship goes both ways.

Relationship between Parents' Education Level and Attitude

The correlation coefficient value between parents' education level and attitude in Table 4 is 0.711 with a probability (sign) of 0.000. The probability value which is smaller than 0.01 indicates that there is a significant relationship between parents' education level and attitudes, and the relationship between the two is positive with a correlation coefficient of 0.711. The alternative hypothesis H_{21} % alpha level. Furthermore, this also means that if there is an increase in the level of parental education, then there is a tendency to increase attitudes and this relationship goes both ways.

Relationship between Parents' Residence and Knowledge

The correlation coefficient value between parents' residence and knowledge in Table 4 is 0.140 with a probability (sign) of 0.208. The probability value greater than 0.10 indicates that there is no significant relationship between the parents' place of residence and knowledge. Alternative hypothesis H_{31} : cannot be accepted at the 10% alpha level. Furthermore, this also means that wherever the parents live (be it in Batam or Surabaya), it has nothing to do with knowledge.

Relationship between Parent's Residence and Attitude

The correlation coefficient value between parents' residence and attitude in Table 4 is -0.433 with a probability (sign) of 0.000. The probability value which is smaller than 0.01 indicates that there is a significant relationship between the parents' place of residence and attitudes, and the relationship between the two is negative. The alternative hypothesis H_{4was} accepted at the 1% alpha level. Furthermore, this significant negative relationship also means that parents who live in group 1, or in this case live in Surabaya, have a higher attitude tendency and this relationship goes both ways.

DISCUSSION

This study showed as the education level of parents increased as the children's dental health. This is in line with research conducted by Ruslan (2016) who conducted research on parents of students with high school and undergraduate education, where the children most affected by dental caries were children whose parents had the last high school education as many as 43 people (90%).¹⁹ First, if we look at the level of education and economic level, based on the results of a field survey conducted by Rustiana et al, it is known that the education level of urban communities is relatively high when compared to coastal communities, namely the majority have a high school education level or bachelor degree.²⁰ This is evidenced by the results of respondents from parents in urban areas, most of whom with a percentage of 75.6% have the latest undergraduate education level, while in coastal areas the majority have the last education level in elementary school with a percentage of 36.6%. This result is also supported by a number of previous studies such as in Afiati, et al (2017), Mayasari & Radianto (2020).^{21 22}

Furthermore, from the knowledge category, most of the parents of PG/TK Benih Kasih Surabaya with a percentage of 75.6%

already have good knowledge about children's dental and oral health, while parents of TK/PAUD Benih Prima Batam children who have good knowledge only amounted to 56.1%. There is a significant difference because most of the parents of the PG/TK Benih Kasih Surabaya have the highest level of education as undergraduates and the parents of the TK/PAUD Benih Prima Batam have the highest level of education in elementary school. This proves that the existence of an adequate level of education can be reflected in the knowledge that parents have. And finally, the category of parental attitudes about children's oral and dental health at PG/TK Benih Kasih Surabaya found that most of the respondents had a good attitude to support their children's dental and oral health properly. Meanwhile, most of the parents at Benih Prima Batam Kindergarten/PAUD are still at an adequate level of attitude in supporting their children's dental and oral health. This is influenced by the level of education and economic level of a person which will shape his attitude in doing something.

External factors that can affect parents' knowledge about children's dental and oral health can be seen from the repetition carried out by parents to children to support their child's dental and oral health. Parents need to know the dominant variables causing caries are the age of the child, the pH of the child's dental plaque, the frequency of consumption of cariogenic children, the weight or height index and family income.²³ The repetition category can be shown from several questions, the first is a question to see whether parents have taught their children how to brush their teeth. Meanwhile, only 97.6% of parents in coastal areas answered that they had taught their children how to brush their teeth. This can prove that parents who put a good level of dental and oral health will do repetition to their children because of good knowledge and experience from repetition that is done regularly will help create a good perception.²⁴ The second question by asking parents whether it is necessary to carry out regular dental and oral

examinations every 6 months, respondents from urban areas 90.2% answered that it was necessary to bring their children regularly, while respondents from coastal areas only 80.5% answered that they needed to bring their children. children to have their teeth checked regularly. Repetition by bringing children to check their teeth every 6 months is important so that not only parents pay more attention to the level of dental and oral health of their children, but children will also pay attention to their level of dental and oral health. From the two questions above, it can be seen that parents in urban areas have good external factors that can affect parents' knowledge about their children's dental and oral health. Most parents in urban areas with a percentage of 75.6% have good knowledge about children's dental and oral health, while parents in coastal areas who have good knowledge are only 56.1%. This proves that when parents have a good level of knowledge about children's dental and oral health, parents will teach children to brush their teeth from an early age and bring their children for regular dental check-ups. When viewed from the results of parent respondents in urban areas, 100% of parents answered that they had exposed their children to cleaning their teeth and mouth and 90.2% thought that it was important to have regular dental and oral examinations. One of the factors that influence this mindset comes from the knowledge that parents have which can affect parents' knowledge about children's dental and oral health. So we can know that the level of parental education is indeed related to knowledge and attitudes related to children's dental health. This is in line with the research conducted by Viana (2022) on 75 respondents at the Department of Pediatric Dentistry at Baiturrahmah Dental and Oral Hospital. The results of dental and oral complaints were 29 people (38.7%), 46 people (61.3%) no complaints. This means that many parents of children in the Department of Pediatric Dentistry, Baiturrahmah University Dental and Oral Hospital, maintain their dental and oral health so

that this behavior becomes a role model for their children to always maintain dental and oral health.²⁵

Based on this research, people who have a low level of education tend to have low knowledge. In the future, it is hoped that health workers and educational institutions will work hand in hand in helping parents of their students in order to improve the knowledge and attitudes of parents regardless of the level of education to support their child's dental and oral health, and as preventive dental health promotive agents can work together in holding Dental Health Education and establish a School Dental Health Unit in schools.

This study also found that there was no significant relationship between parents' residence and knowledge. This means that there is no relationship between parents' knowledge of children's dental health and where they live, whether they live on the coast of Batam or urban Surabaya. Parents with a younger age range will be more advanced in terms of knowledge because of the many available information facilities. In this study, most of the parents in urban and coastal areas had an age range of 25-34 years, so there was no significant relationship between residence and knowledge.

On the other hand, this study also showed that there was a significant relationship between parental residence and attitudes, and the relationship between the two is negative. This negative relationship indicates that parents who live in Surabaya have a tendency towards better dental health. Factors that can influence parents' attitudes about their children's dental and oral health are predisposing, enabling, and reinforcing factors. The predisposing factors are seen from the categories of knowledge, attitudes, education level, and economic level that underlie parents' attitudes towards their children's dental and oral health. As people who live in urban areas, most of the people's livelihood is as an employee or office worker.²⁶ This is not proven by the results of the respondents that the researchers got, with a

percentage of 53.7% of parents in urban areas having jobs as housewives, this happens because in general with a percentage of 97.6% of respondents filled by women so that they do not become a it is surprising if the majority of the work owned is filled with housewives. Differences in education levels affect the movement of the economic level of each place, as we know most of the livelihoods of coastal communities are engaged in processing and trading marine products which are obtained.¹⁵ This is not proven by the results of the respondents that the researchers got, with a percentage of 48.8% of parents in coastal areas also having jobs as housewives, this happens because in general with a percentage of 80.5% of respondents filled by women so they do not become a housewife. Furthermore, from the category of parents' attitudes about children's dental and oral health in urban areas, it was found that most of the respondents had good attitudes to support their children's dental and oral health properly. Meanwhile, most of the parents in coastal areas are still at an adequate level of attitude in supporting the dental and oral health of their children. This is influenced by the level of education and economic level of a person which will shape his attitude in doing something.

Based on this study, there was a significant relationship between the parents' place of residence and attitudes, and the relationship between the two was negative. Furthermore, this significant negative relationship also means that parents who live in Surabaya, have a higher attitude tendency and this relationship goes both ways.

This study highlights the importance of parents' level of education toward a knowledge and attitude toward children oral health. As only two cities are selected to be the representative of urban and coastal area, future studies could again explore the notion of environment or residence impact parental knowledge and attitude toward children oral health.

CONCLUSION

This study showed as the education level of parents increased as the children's dental health and attitudes. Parents who live in urban areas (Surabaya) have a higher attitude tendency and this relationship goes both ways. It is hoped that health workers and educational institutions work together to pay more attention to the dental and oral health of children aged 3-6 years by increasing parental knowledge by holding dental and oral health counseling so that they can emphasize good habits that parents can do at home. and implemented in their children.

ACKNOWLEDGMENTS

We express our gratitude to the Faculty of Dentistry, Universitas Hang Tuah who has supported this research.

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The Relationship of Knowledge and Attitude Towards Hand Washing Behavior in Baiturrahmah Dental Hospital During the Covid-19 Pandemic

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Online submission : 14 June 2022

Accept Submission : 09 June 2023

ABSTRACT

Background: Dental practice is very susceptible to nosocomial infections. One of the infection control prevention efforts that can be done is by washing hands. Hand washing is a process that removes dirt on the hands by using a detergent containing an antiseptic agent and running water. **Objective:** To determine the relationship between knowledge and attitudes towards hand washing in professional students at Baiturrahmah Dental Hospital during the COVID-19 pandemic. **Method:** This research was a type of quantitative research using observational analytic method with a cross-sectional design. This research was conducted at Baiturrahmah Dental Hospital which was held in November–December 2021. The sampling technique in this study was consecutive sampling. The number of samples in this study was 80 samples. Research through the google form given by researchers to research respondents. **Result:** This study indicated that most of the respondents have good knowledge of hand washing (91.2%), good hand washing attitudes (99.0%), and good hand washing behavior (100.0%). The correlation analysis test was carried out using the Pearson correlation test for parametric analysis and the Spearman correlation test for non-parametric analysis. There was a significant relationship between knowledge of hand washing behavior ($p < 0.05$) and attitudes towards hand washing behavior ($p < 0.05$). **Conclusion:** There was a significant relationship between knowledge of handwashing behavior in professional students at Baiturrahmah Dental Hospital and there is a significant relationship between attitudes towards handwashing behavior in professional students at Baiturrahmah Dental Hospital.

Keywords: Handwashing, Knowledge, Attitude, Behavior, COVID-19, COVID-19 Prevention

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INTRODUCTION

Based on data from the COVID19.go.id website on November 28, 2021, from 510 districts in 34 provinces the number of confirmed positive cases of COVID-19 in Indonesia was 4,255,672 cases, the number of deaths was 143,807 cases, the number of recovered cases was 4,103,639. The spike in COVID-19 cases continues in Indonesia with the highest daily increase in new confirmed cases.⁴

Prevention efforts to minimize the spread of COVID-19 transmission are by maintaining and implementing health protocols such as using masks, washing hands, keeping a distance and bringing the equipment needed when leaving the house such as hand sanitizer, bringing your own eating utensils, bringing your own prayer utensils and other necessities.⁶

Hand washing is a process that mechanically removes dirt on the hands by using a detergent containing an antiseptic agent and running water, starting from the fingertips to the elbows and arms in a certain way according to need. Cleaning hands with water and soap, the level of efficacy in removing bacteria on hands can be different, in this case if only washed with water, only a few bacteria will come out, while soap can remove a lot of bacteria because in soap there are special ingredients that can control the bacteria present on the hands. In this case, there are several active ingredients contained in hand soap, namely alcohol, emollient, triclocarban, triclosan, triclocarban, and others.⁹

According to control center data infection in the United States using hand sanitizer more than 5 times showed the ineffectiveness of alcohol-based ingredients and the accumulation of a number of germs that grows on the build-up of moisturizers and fragrances from cleaning fluids hands, so it is necessary to continue with washing hands with soap after five wash your hands frequently with hand sanitizer.¹²

Health students who work in hospitals are at high risk, so it is important for them to

increase their self-awareness about health information that is important to themselves. Health issues, health problems, and best health solutions need to be understood and used as health information to improve and maintain their health. So that health students when they graduate and then work can immediately adapt to the work environment in breaking the chain of health problems that occur.¹⁸

The results of research conducted by Apriani (2020) with a significance value (0.000) which means that there is a relationship between the knowledge of health workers on hand washing behavior at the Raja Ahmad Tabib Hospital, Riau Islands Province in 2019. The results of research also conducted by Apriani (2020) with a significance value (0.000) which means that there is a relationship between the attitude of health workers to hand washing behavior at the Raja Ahmad Tabib Hospital, Riau Islands Province in 2019.²

Antiseptic handwashes are soaps or synthetic detergents that have an added antimicrobial component. These antimicrobial ingredients disrupt the integrity of the viral membrane. Various antimicrobial ingredients were reviewed and rated for their relative efficacy as a virucidal agent and potential allergenicity (Table I). Alcohols, bleach, and iodophor-containing solutions are the most effective against viruses. The antiviral activity of alcohol is attributed to its ability to denature proteins.¹⁶ The antiviral activity of povidone iodine is noted to rapidly penetrate the cells of microorganisms, inactivate cellular replication, and impair protein synthesis.¹⁵

As vaccine or approved drugs are not available for COVID-19, it is advisable to prevent its spread by following simple measures as prescribed by WHO: (a) Hand hygiene: Regularly wash hands with soaps and when washing facility is not available to clean hands with alcohol-based hand rubs; (b) Social distancing: Maintain at least 3 feet distance with others and avoid visiting crowded places, if possible; (c) Respiratory hygiene: Use a tissue

or cover your mouth and nose with the bent elbow while sneezing or coughing, or always wear a mask when going outside or visiting any public place; (d) Stay home and stay safe: Stay at home and self-isolate in case of feeling unwell or having any symptoms of cough, fever, headache. In brief, personal hygiene is key to prevent the spread of this contagious disease. Soaps and hand sanitizers play a crucial role in maintaining personal hygiene to fight against COVID-19.⁵

The active components of soaps are detergents derived from the petrochemicals, while the recommended hand sanitizers contain high concentrations of alcohol. The detergents and alcohol cause skin irritation and dryness and are hazardous to the environment. Therefore, there is a need for eco-friendly soaps and hand sanitizers for human and environmental safety.⁵

Various nature-based compounds such as microbial biosurfactants and plant secondary metabolites have been reported to have antimicrobial and virucidal activities. These natural compounds are usually non-toxic and easily biodegradable. Therefore, this short-review aims to highlight the health and environmental concerns of using soaps and alcohol-based hand sanitizers amid COVID-19 and to discuss the potential of some of the natural detergents and sanitizing agents as eco-friendly alternatives to petrochemical-based soaps and alcohol-based hand rubs for hand hygiene.⁵

The health care system must ensure the availability of appropriate PPE adequately and develop additional strategies to protect officers' health from COVID-19. Use of masks by healthcare workers recommended by WHO, namely surgical masks and N95 masks. Based on the results of research on N95 masks compared to surgical masks found that masks N95 has better capability in good laboratory testing used in inpatient or outpatient care.³

According to Budiman and Riyanto, (2013) factors that can influence a person's knowledge are: education, information, socio-

economic culture, environment, experience, and age. attitude is evaluation or emotional reaction. A person's attitude towards an object is a feeling support or take sides or feelings do not support or do not take sides on object.¹ Behavior is everything activities or activities carried out by someone, as a reaction or response to external stimuli, which reflect their knowledge and attitudes.⁸

Dental profession students study at Baiturrahmah Dental Hospital. Baiturrahmah Dental and Oral Hospital (FKG Unbrah Hospital) is one of the health services in the field of dental and oral health located in the city of Padang, West Sumatra. The Hospital is a three-story building: The first floor consists of an academic room and several other rooms and there is one department, namely Pediatric Dentistry. The second floor consists of seven departments, namely Oral Surgery, Public Dental Health, Dental Conservation, Periodontics, Oral Diseases, Prosthodontics, and Orthodontics. The third floor has a lecture room.²⁰

MATERIALS AND METHODS

This research is a type of quantitative research using observational analytic method with a cross-sectional design. This research was conducted at the Baiturrahmah Dental Hospital Padang which was held in December 2021. The population for this study were professional students at the Baiturrahmah Dental Hospital. The number of professional students at Baiturrahmah Dental Hospital on October 19, 2021 was 349 students.¹¹

Based on the Slovin formula used, the minimum number of samples used in this study was 78 samples. The sampling technique in this study is consecutive sampling. The independent variables in this study are knowledge and attitudes about hand washing, while the dependent variable in this study is hand washing behavior.¹⁶

Knowledge is interpreted as the respondent's understanding of correct hand

washing with a quantitative scale, namely knowledge in good categories must answer questions correctly > 6 questions out of 10 questions given, knowledge is said to be sufficient when respondents answer questions correctly 4-6 questions out of 10 questions, and poor category knowledge is obtained when the correct answer is <4 questions out of 10 questions given. Attitudes were measured using a Likert scale and then interpreted quantitatively with a good attitude category with a score of 27-36 points from 9 questions, attitudes were said to be sufficient when they had a score of 9-27 points out of 9 questions, and the poor category scored <9 points out of 10 questions. Behavior is measured using a Likert scale and then interpreted quantitatively with the category of good behavior.¹⁰

Score of 19-20 points out of 10 questions, behavior is said to be sufficient when it has a score of 11-19 points out of 10 questions, and the poor category scores <11 points out of 10 questions.¹⁰

Data collection in this study consisted of informed consent, smartphones, and online questionnaires via a google form given to researchers for research, the population for this study were professional students at Baiturrahmah Dental Hospital Padang.

The normality test used in this study is the Kolmogorov-Smirnov normality test using SPSS version 20.0. After the Kolmogorov-Smirnov normality test was carried out, to find the relationship between knowledge and handwashing behavior of professional students at Baiturrahmah Dental Hospital using the Pearson correlation test, while to find out the relationship between attitudes towards handwashing behavior of professional students at Baiturrahmah Dental Hospital used the Spearman correlation test with a significance of $p < 0,05$.¹⁷

RESULTS

The results of research conducted on 80 respondents, obtained data on the characteristics of respondents including generation and gender. Respondent characteristics data can be seen below.

Table 1. Distribution of Respondents Characteristics

		Frequency	%
Generation	2019	42	52.5
	2020	24	30.0
	2021	14	17.5
	Total	80	100.0
Gender	Male	30	37.5
	Female	50	62.5
	Total	80	100.0

Based on generation and Gender in Professional Students at Baiturrahmah Dental Hospital From table 1, it can be seen that the most respondents were the 2019 generation, which was 42 people (52.5%), followed by the 2020 generation as many as 24 people (30.0%) and the 2021 generation as many as 14 people (17.5%). From table 1 it can also be seen that the respondents of this study were dominated by female as many as 50 respondents (62.5%) while male respondents were (37.5%).

Table 2. Levels of Handwashing Behavior Based on Gender and year in Professional Students at Baiturrahmah Dental Hospital.

Gender	Handwashing Behavior					
	Good		Sufficient		Poor	
	N	%	n	%	n	%
Male	30	37.5	0	0.0	0	0.0
Female	50	62.5	0	0.0	0	0.0
Total	80	100	0	0.0	0	0.0
Generation	N	%	n	%	n	%
2019	42	52.5	0	0.0	0	0.0
2020	24	30.0	0	0.0	0	0.0
2021	14	17.5	0	0.0	0	0.0
Total	80	100	0	0.0	0	0.0

From table 2 it can be shown that female respondents and male respondents have good behavior towards hand washing. 50 female respondents had good behavior towards hand washing (62.5%) while male respondents with a total of 30 respondents also had good behavior towards hand washing (37.5%). From table 2, it can be shown that all respondents have good behavior towards hand washing. The 2019 generation of 42 respondents had good behavior (52.5%), the 2020 generation of 24 respondents had good handwashing behavior (30.0%), and the 2021 generation of 14 respondents had good handwashing behavior (17.5 %).

Table 3. Distribution of Respondents by Knowledge, Attitudes, and Behaviors About Handwashing in Professional Students at Baiturrahmah Dental Hospital

		Frequency	%
Knowledge	Good	73	91.2
	Sufficient	7	8.8
	Less	0	0.0
	Total	80	100.0
Attitudes	Good	79	98,8
	Sufficient	1	1.2
	Less	0	0.0
	Total	80	100.0
Behaviors	Good	80	100
	Sufficient	0	0.0
	Less	0	0.0
	Total	80	100.0

Table 3 described the distribution of respondents according to knowledge about hand washing. In the distribution of respondents according to general knowledge, respondents had good knowledge of hand washing, namely 73 respondents (91.2%) had good knowledge. The distribution of respondents with sufficient knowledge was 7 respondents (8.8%) while the distribution of poor knowledge was not found in this study.

Table 3 described the distribution of respondents according to attitudes towards hand washing. The distribution of respondents according to the attitude of 79 respondents (99.0%) was good, 1 respondent (1.0%) was

sufficient, while the distribution was not good, not found in this study. Based on the results of research that has been carried out, it showed that the attitudes of professional students about hand washing were mostly in the good category, namely as many as 79 respondents (99.0%), the attitudes of professional students towards hand washing were in good enough category as many as 1 respondent (1.0%), and there were not respondents with less good category.

Table 3 explained that the behavior of professional students regarding hand washing with a good category distribution of 80 respondents (100.0%), sufficient and poor distribution were not found in this study. The results of the study showed that professional students had good behavior towards hand washing. This was obtained from the results of research where all respondents had a score of 19-30 which is categorized into good behavior.

Table 4. The Relationship of Knowledge and Handwashing Attitudes to Handwashing Behavior in Professional Students at Baiturrahmah Dental Hospital

	Correlation coefficient	p-value
The relationship between hand washing knowledge and hand washing behavior	0.504	0.000
The relationship between hand washing attitudes and hand washing behavior	0.388	0.000

The results of Pearson's analysis using SPSS version 20.0, a p-value of 0.000 ($p < 0.05$) showed that there was a significant relationship between knowledge and behavior of professional students about hand washing at Baiturrahmah Dental Hospital. The results of data processing in table 4, the correlation coefficient number was 0.504, meaning that the level of strength of the relationship (correlation) between knowledge and behavior variables was 0.504 or strong enough (correlation coefficient >

0.05). Figures in table 4 the correlation coefficient was positive, namely 0.504 so that the relationship between the two variables was unidirectional (type of unidirectional relationship) thus it can be interpreted that the better the knowledge, the better the behavior.

The results of the Spearman test analysis using SPSS version 20.0, a p-value of 0.000 ($p < 0.05$) was obtained, meaning that there was a significant relationship between attitudes towards professional student behavior about hand washing at Baiturrahmah Dental Hospital. The results of data processing in table 4, the correlation coefficient number was 0.388, meaning that the level of strength of the relationship (correlation) between the attitude and behavior variables was 0.388 or a sufficient correlation (0.26-0.50). The number of correlation coefficients in table 4 was positive, namely 0.388 so that the relationship between the two variables was unidirectional (type of unidirectional relationship), thus it can be interpreted that the better the attitude, the better the behavior.

DISCUSSION

Characteristics of respondents in this study include generation and gender. The results of the study showed that the majority of respondents were female and the generation of 2019 was the oldest generation in this study. The results also showed that the respondents of this study were dominated by women, namely 50 respondents (62.5%) while male respondents were (37.5%). There were more female respondents than male respondents, in line with research conducted by Priyanto (2014) which states that women's interest in entering the faculty of dentistry is higher than men. The results of the study showed that the research respondents were dominated by the 2019 generation, this was because the 2019 generation was the senior generation with the largest population.¹³

The results of the analysis of the Pearson parametric relationship test obtained a p-value of 0.000 ($p < 0.05$) meaning that there was a significant relationship between knowledge and behavior of professional students about hand washing at Baiturrahmah Dental Hospital. The level of strength of the relationship (correlation) between the knowledge and behavior variables is 0.504 or the correlation was quite strong. From the results of data analysis, it was found that the number on the correlation coefficient was positive, namely 0.504 so that the relationship between the two variables was unidirectional (type of unidirectional relationship), thus it can be interpreted that the better the knowledge, the better the behavior. This is because respondents with sufficient knowledge have sufficient actions, and respondents with good knowledge have good actions, so that when the correlation test using Pearson was carried out, the p-value < 0.05 , which means that there was a relationship between knowledge and washing action.

The results of this study were in line with research conducted by Apriani (2020) with a significance value (0.000) which means that there is a relationship between the knowledge of health workers on hand washing behavior at the Raja Ahmad Tabib Hospital, Riau Islands Province in 2019. This is in accordance with L. Green's theory which stated that the three main factors that influence health behavior one of which is knowledge. It is expected that the better the respondent's knowledge about hand hygiene, the better their compliance behavior to do hand hygiene.²

The same research results were obtained by Harlinisari (2018) with a significance value (0.0001), which means that knowledge has a significant and positive influence on the behavior of midwives in carrying out the Standard Operating Procedures for hand washing. The higher the level of knowledge of the midwife, the higher the compliance of the midwife in carrying out the Standard Operating Procedure for hand washing. The results of this study were also in line with research conducted

by Thirayo (2021) with a significance value (0.002), which means that there is a significant relationship between nurses' knowledge and hand washing behavior.⁷

The results of this study were not in line with research conducted by Rabbani S (2013) with a significance value of (0.160) which means that there is no (positive) relationship between knowledge and hand washing behavior of health workers in the Child Health Sciences Section of BLU RSUP Prof dr. RD Kndou Manado. Poor hand washing behavior can be influenced by the lack of good and functioning hand washing facilities, such as sinks, water faucets, hand soap, and dry towels or tissues.¹⁴

The Relationship between Handwashing Attitudes and Handwashing Behavior

The results of the Spearman test analysis, a p-value of 0.000 ($p < 0.05$) was obtained, meaning that there was a significant relationship between attitudes towards hand washing behavior of professional students at Baiturrahmah Dental Hospital. From the results of data processing obtained a correlation coefficient of 0.388, meaning that the level of strength of the relationship (correlation) between the attitude and behavior variables is 0.388 or sufficient correlation. The results of data analysis obtained a positive correlation coefficient of 0.388 so that the relationship between the two variables is unidirectional (type of unidirectional relationship), thus it can be interpreted that the better the attitude, the better the behavior.

The results of this study are in line with research conducted by Apriani (2020) with a significance value (0.000) which means that there is a relationship between the attitude of health workers towards hand washing behavior at the Raja Ahmad Tabib Hospital, Riau Islands Province in 2019. Attitude is a factor contained in individuals who can influence individuals to comply with standard operating procedures in the workplace.²

The same research results were obtained by Harlinisari (2018) with a significance

value (0.0001), which means that attitudes have a significant and positive influence on the behavior of midwives in carrying out the Standard Operating Procedures for hand washing. The better the attitude of the midwife, the higher the level of compliance of the midwife in carrying out the Standard Operating Procedure for hand washing.⁷

The results of this study are not in line with the research conducted by Thirayo (2021) with a significance value (0.072) which means that there is no significant relationship between the attitudes and behavior of nurses on hand washing behavior. These results also show that the majority of nurses say that there are no rewards and punishments for nurses when complying with the implementation of hand hygiene so that in practice nurses have motivation to practice hand hygiene due to lack of supervision.¹⁹

CONCLUSION

Based on research conducted on professional students at Baiturrahmah Dental Hospital, the conclusion that can be drawn by researchers is that there is a significant relationship between knowledge of handwashing behavior in professional students at Baiturrahmah Dental Hospital and there is a significant relationship between attitudes towards handwashing behavior in professional students at Baiturrahmah Dental Hospital. suggestions for future researchers to carry out further research among professional students on an ongoing basis as an effort to monitor infection prevention and prevention programs at RSGM Baiturrahmah.

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