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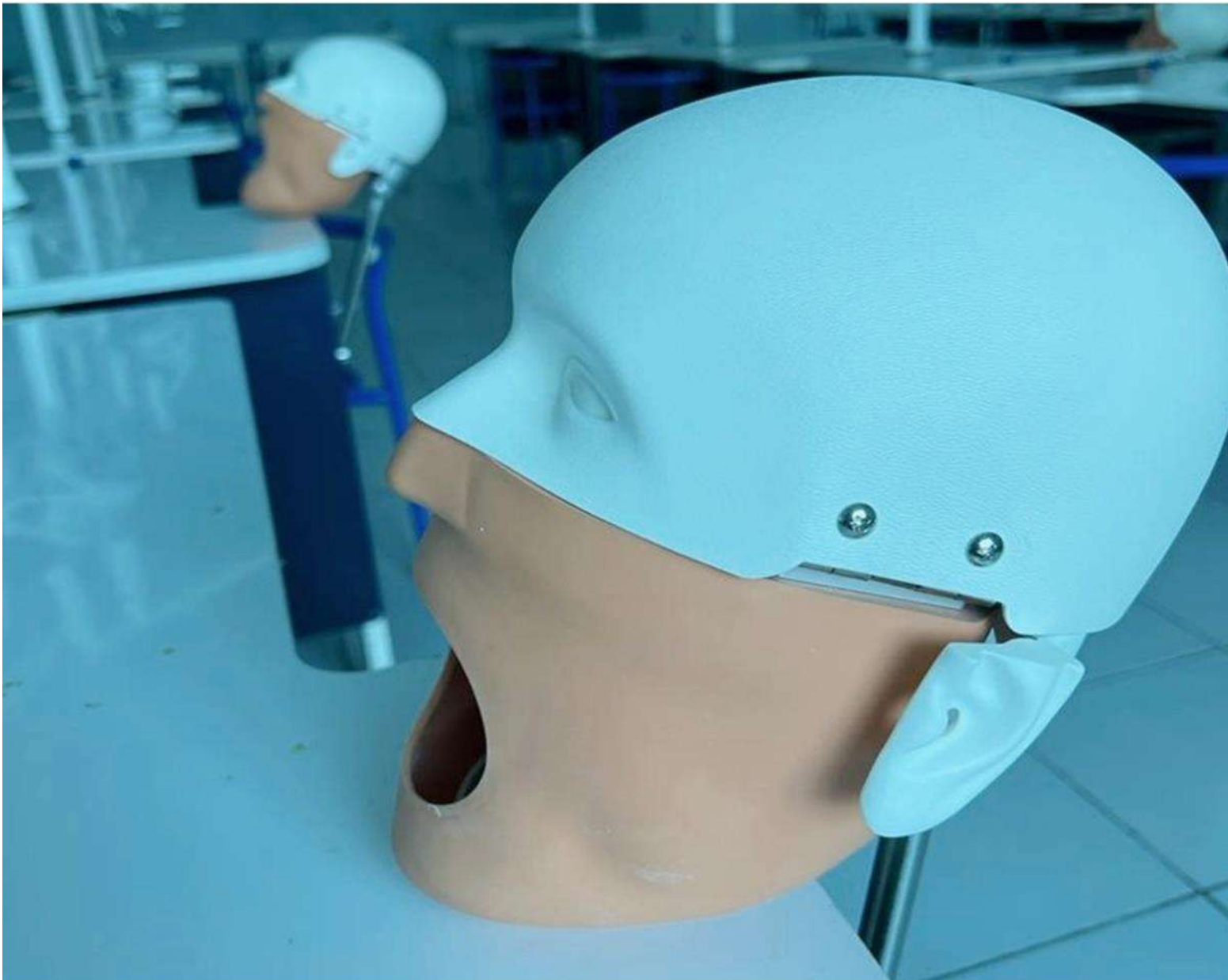
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Covid-19 Awareness for Baiturrahmah Padang Bachelor of Dental Medicine Students

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ABSTRACT

Background: Coronavirus, or SARS-CoV2, is one of the main pathogens that attack the human respiratory system. The coronavirus disease caused by SARS COV2 represents the causative agent of a potentially fatal disease of global public health concern. West Sumatra is in the top 10 provinces that contributed the most COVID-19 cases in Indonesia. 1st According to the official website of the Health Padang City Service on September 22, 2020, 2385 confirmed COVID-19 people, 1426 people recovered from COVID-19, and 53 people died. The high incidence of positive cases of Covid-19 in Padang is due to a lack of public knowledge and adherence to government-mandated health practices. Dental care places have a risk of COVID-19 infection due to aerosols generated during procedures, handling of sharp objects, and the proximity of dentists to patients. Dentistry students must have an awareness of deep knowledge, a better understanding, and must be updated with the practice of adapting to identify possible COVID-19 infections. **Objective:** The aim is to increase awareness about COVID-19 among undergraduate dentistry students at the Baiturrahmah Faculty of Dentistry, Padang. **Methods:** This type of research is called descriptive research. The target population of this study was undergraduate dentistry students in 2017, 2018, and 2019, with a sample of 175 people. This research was conducted online in the city of Padang using Google Forms Media for distributing questionnaires. When the research was carried out in September 2020. **Results:** The results showed that as many as 99.4% of respondents had good knowledge awareness about COVID-19, 0.6% awareness of bad knowledge, 97.7% of respondents got the first information about COVID-19 through the media, 56% of respondents got the latest Covid information via the internet, only 11.4% of respondents are taking Covid-19 courses, and 5.1% are still taking courses until now. The method of data analysis in this study used the SPSS program with univariate and bivariate analysis. The processed data is presented in table form. **Conclusion:** Students have awareness about COVID-19.

Keywords: Awareness, COVID-19 and Undergraduate Dentistry Students

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INTRODUCTION

In early 2020, the world was shocked by a virus that has spread to several countries, the new sars-cov-2 virus, which causes a disease called COVID-19.¹ Corona most likely originates from zoonoses, namely the transmission of infection from animals to humans, then shows human-to-human transmission through droplets containing the COVID-19 virus.² The etiology of COVID-19 belongs to the genus betacoronavirus. Coronavirus itself is a virus that originates from the subfamily Orthocoronavirinae in the family *Coronaviridae* and the order *Nidovirales*^{19,20}. Phylogenetics shows that this virus belongs to the same subgenus as the Severe Acute Respiratory Illness (SARS) coronavirus.³ The virus is mainly transmitted by respiratory droplets and direct or indirect contact. Droplet transmission occurs when a person is within 1 m. Transmission Indirect contact through surfaces that can transmit the virus, such as a stethoscope used on an infected person.⁴ Signs and symptoms appear within two to 14 days of exposure. Common symptoms include fever, cough, shortness of breath, or difficulty breathing. Other symptoms include fatigue, body aches, chills, sore throat, loss of smell and taste, diarrhea, and severe vomiting.⁵ On April 10, 2020, WHO noted the coronavirus had affected 212 countries, with a total of 1,439,516 positive cases of COVID-19 and 85,711 deaths. On March 2, 2020, two positive cases of COVID-19 were first announced on television in Indonesia. Indonesia itself started with Covid-19 confirmation patients at an event in Jakarta where the patient was in contact with a foreign national (WNA) from Japan. After the meeting, the patient complained of a fever, cough, and shortness of breath. For 3 consecutive months from December to October 2020, West Sumatra is in the top 10 provinces that contributed the most COVID-19 cases in Indonesia¹⁸.^{1st} According to the official website of the Health Padang City Service on September 22, 2020, 2385 confirmed COVID-19 people, 1426 people recovered from COVID-19, and 53

people died.⁶ The high incidence of positive cases of Covid-19 in Padang is due to a lack of public knowledge and adherence to government-mandated health practices. Person-to-person transmission of the disease makes isolation of the patient an extremely important part. ViRus is widely present in salivary secretions and the nasopharynx of patients. Given the widespread spread of COVID-19 and reports of transmission to healthcare providers, dental professionals are at the highest risk for nosocomial infection and can become potential carriers of the disease. Four dental care places have a risk of COVID-19 infection due to aerosols generated during the procedure, handling of sharp objects, and the proximity of the dentist to the patient's oropharynx. The dental clinic has the potential to cause cross-contamination if precautions are not taken. With the development of understanding about the current COVID-19 disease, dentistry students must have a deep understanding of knowledge, a better understanding, and must be updated with the practice of adapting to identify possible COVID-19 infections. Based on this, researchers are interested in conducting research to find out the awareness of COVID-19 among undergraduate dentistry students at the Baiturrahmah Faculty of Dentistry, Padang.

MATERIALS AND METHODS

This type of research is called just descriptive research. The population in this study was the total number of undergraduate students in 2017, 2018, and 2019 at the Baiturrahmah Faculty of Dentistry, Padang, with a sample of 175 people. This research was conducted online in the city of Padang using *Google Forms Media* for distributing questionnaires. When the research was carried out in September 2020,

Sampling Method

The research instrument consisted of an awareness questionnaire containing questions consisting of the knowledge domain and the action domain about COVID-19.



Procedure

Researchers create a Google form that contains a questionnaire. The questionnaires were sent to undergraduate students in the classes of 2017, 2018, and 2019 through links. The researcher gave students three days to fill out a Google form in 2017, 2018, and 2019. In classes in 2017, 2018, and 2019. after 3 days the researcher looked at the number of participants who filled out the questionnaire which found 175 people After the Google form is filled in, the researcher collects the Google form. Then the researcher performs data processing. Data processing is presented in the form of tables and percentages.

Data analysis

The method of data analysis in this study used the SPSS 20 program with univariate and bivariate analysis. The processed data is presented in tabular form.

RESULTS

This study aims to determine the awareness of COVID-19 among undergraduate dentistry students at the Baiturrahmah Faculty of Dentistry, Padang which was conducted on 175 research samples that met the inclusion and exclusion criteria. Based on the results of the collection and analysis of the data that has been obtained, the authors can conclude the research results in the following presentation. Student the biggest number of generations in 2018 were 78 people, based on the distribution of respondents depending on the generation gathered from 175 respondents (44.6 %). In 2017, the lowest number of respondents (26.8%) was 47, while in 2019, the number of respondents was 50. (28.6 %).

Table 1. Frequency distribution (%) based on knowledge domain components

Question	Correct answer	Wrong answer	p value
The origin of the disease COVID-19	173 (98.9%)	2 (1.1%)	>0.05
Epidemiology	173 (98.9%)	2 (1.1%)	>0.05

The etiology of the COVID-19 disease	153 (87.9%)	21 (12.1%)	>0.05
Transmission mode Disease	174 (99.4%)	1 (0.6%)	<0.05
Clinical features	169 (96.6%)	6 (3.4%)	<0.05
Diagnosis	173 (98.9%)	2 (1.1%)	<0.05
Prevention	174 (99.4%)	1 (0.6%)	<0.05
Treatment	174 (99.4%)	1 (0.6%)	<0.05
Pandemic	168 (96%)	7 (4%)	<0.05
Disaster management	174 (99.4%)	1 (0.6%)	<0.05

Based on table 1 above, out of 175 respondents about awareness of COVID-19 among undergraduate dentistry students at the Baiturrahmah Faculty of Dentistry, Padang, the number of students who answered correctly was 173 (98.9%). In this study, 173 students (98.9%) chose the correct answer. Questionnaire questions about the etiology of COVID-19 students were answered correctly by 87.9%. The choices in the answers to the questionnaire about the student's mode of transmission were 174 (99.4%) correct, the clinical picture was 169 (96.6%), the diagnosis of COVID 173 (98.9%), the prevention of 174 (99.4%), the pandemic 168 (96%), and disaster management 174 (99.4%).

Table 2. Frequency distribution (%) based on action domain components

Question	Frequency -n(%)
	Number (n = 175)
The first source information COVID-19 disease	Friend 1 (0.6%) Family 3 (1.7%) Educational institutions 0 (0%) Media 171 (97.7%)
Latest sources information about COVID-19	Internet 98 (56.0%) News 53 (30.3%) WHO / IDA 13 (7.4%) Government website 4 (2.3%) 7 (4%)
take a course about COVID-2019	Not 155 (88.6%) Yes 20 (11.4%)
still taking courses on covid to date	Not 166 (94.9%) Yes 9 (5.1%)

Based on table 2 above, out of 175 respondents about awareness of COVID-19 among undergraduate dentistry students at the Baiturrahmah Faculty of Dentistry, Padang, on the question of the source for the first time getting COVID-19 information, in the table above, it can be seen that students received information for the first time most through the media, 171 (97.7%). In the question of the latest source of information about COVID-19, many students got the latest information via the internet (56.0%). In the questionnaire questions about students who took courses on COVID-19, only 20 (11.4%) of students took part, whereas there are only 9 (5.1%) students who are still taking courses on COVID-19.

Table 3. Knowledge mean ranges and frequency (%) of undergraduate students in different categories

		The correct frequency response (n)	percentage (%)
Mean Range of Knowledge (Category)	Low	1	0.6%
	Good	174	99.4%
	Total	175	100 %

In this research, based on the average range of knowledge and the frequency of students in the good and low categories, it can be concluded in table 3 that undergraduate students at the Baiturrahmah faculty of dentistry have good knowledge of 99.4%.

DISCUSSION

This research confirms the need to know the latest awareness and appropriate knowledge about the COVID-19 disease among dentistry students. Given the widespread spread of SARS-CoV-2 and reports of transmission to healthcare providers, dental professionals are at the highest risk for nosocomial infection and may become potential carriers of the disease. Among health care professionals, almost a 90% chance

of infectivity is with dental professionals. This can have serious implications for dental practice. Dental care places have a risk of 2019-nCoV infection due to aerosols generated during the procedure, handling of sharp objects, and the proximity of the dentist to the patient's oropharynx area. If preventive measures are not taken, dental clinics have the potential to cause cross-contamination, so it is important to know the knowledge and awareness of students about COVID-19.

The results of research on awareness about COVID-19 among undergraduate dentistry students at the Baiturrahmah Faculty of Dentistry, Padang, based on table 1 of 175 undergraduate students from the dental faculty about the origin of the disease COVID-19 who answered correctly (98.9%) Meanwhile, Khasid et al.'s 2020 research in India answered correctly 64.5% of the time. this question, it can be concluded that dentistry students have good knowledge of the origin of COVID-19. In the epidemiological questions of COVID-19, students who answered correctly (98.9%) were higher than the research conducted by Khasid et al. in India in 2020 (77.3%) It can be concluded that students have good knowledge of the epidemiology of COVID-19, as the epidemiology of COVID-19 is already at the pandemic stage.

The questionnaire on the question about the etiology of the COVID-19 disease showed that many students who answered correctly were (87.9%). The proportion of respondents who correctly answered the etiology questions in this study was higher than in the research conducted in India in 2020, which amounted to 53.2% The number of respondents who answered correctly in this study was lower than in the study conducted in Nepal in 2020, where students who answered correctly about the etiology of COVID-19 were 95.6%. On the etiology question, Baiturrahmah dentistry students had good knowledge of etiology. COVID-19 originates from the SARS CoV2 virus. The results of research on the method of transmission of the COVID-19 disease among students who answered correctly amounted to 96.6%. 71% ⁴. Another study was also carried out in Saudi Arabia in 2020. As many as 92% answered the transmission of COVID-19 through

droplets¹⁶. Most Baiturrahmah dental faculty students have good knowledge by knowing that the transmission of COVID-19 occurs through respiratory droplets.

Questionnaire questions about the clinical picture of COVID-19 students who answered correctly (96.6%). This number is greater than research conducted in India, which answered correctly (54.8%). Students have good knowledge of the clinical picture of COVID-19 (Khasid et al. 2020). The clinical symptoms of COVID-19 vary depending on the degree of disease. The main symptoms are fever, cough, myalgia, shortness of breath, headache, diarrhea, nausea, and abdominal pain.

In the questionnaire questions about how to diagnose COVID-19, the number of Baiturrahmah dentistry students who answered correctly amounted to (98.9%). The same study was conducted in India, and the number of students who answered correctly was (33.9%) (Khasid, et al.). From this question, it can be concluded that Baiturrahmah Faculty of Dentistry students have good knowledge of the diagnosis of COVID-19. Prevention of COVID-19 is very important for students to know. In this question questionnaire, students have good knowledge because the number of students who answered correctly was 99.4%.

A similar study was also conducted on dentistry students in India who answered correctly (76.3%), while the research conducted in Nepal of students who chose the correct answer was 99.3%⁴. COVID-19 prevention can be done with the main prevention being limiting the mobilization of people at risk until the incubation period. Other precautions include increasing endurance through healthy food intake, increasing hand washing, using a mask if you are in a risky area, exercising, getting enough rest, eating food that has been cooked until it is cooked, and immediately going to the hospital if there is illness. In the knowledge domain, it can be concluded that Baiturrahmah Padang dentistry students have a good level of knowledge, which can be seen from the average knowledge in Table 3, which states that the average knowledge of students is good at 99.4%.

Students have good knowledge of the treatment of COVID-19 because the number of students who answered correctly was 99.4%. In the same study in India, students who answered correctly were (31.1%)⁴. Questionnaire questions about the COVID-19 pandemic Students have good knowledge. Students can answer correctly (96%), while in India as many as (32.7%) can answer correctly (Khasid, et al. 2020). Many students answered correctly (99.4%) in the questionnaire questions about disaster management. This is higher than the research conducted in India, which answered correctly (23.9%). It can be concluded from this research that FKG Baiturrahmah students have good knowledge of the disaster management of COVID-19 about promotions that focus on hand washing, social distancing, and information on the risk of COVID-19 transmission..

The results of the research in table 2 on the domain of action show that students get the first information about COVID-19 through the media (97.7%), followed by family (1.7%) and friends (0.6%). The same results from research conducted by Khasid et al in 2020 show that students get the most first-time information about COVID-19 through the media (76.1%)⁴. Students get the most up-to-date sources of information about COVID-19 in this study via the internet (56%), then in second place is news (30.3%), followed by WHO (7.4%), government (4%) and finally the website (2.3%). In table 2, it can be seen that most of the knowledge found by Baiturrahmah dentistry students is sourced from the Internet. This research is also supported by other research in India which states that most students get information from the internet.

In table 2, on the question of whether students take courses on COVID-19, as many as (88.5%) students do not take courses on COVID-19, while students who answer yes only (11.4%), and on the question of whether students are still taking courses on COVID-19, as many as (94.9%) students answered no, and only students who are still taking courses on COVID-19 to date (5.1%). The same study in India had different results. Students in India followed suit, 70.5% of courses, and are still attending until now (44.5%). In the domain of action, it can be



concluded that students have an awareness of COVID-19, although few have taken courses, and have good knowledge of COVID-19.

CONCLUSION

Based on the research results, it was concluded that Baiturrahmah Padang Dentistry students at the undergraduate level had good knowledge about COVID-19. In the domain of action, students have awareness about COVID-19. Students get information about COVID-19 for the first time through the media, and get the latest information via the internet, and most students do not take courses on COVID-19.

REFERENCES

1. Yuliana. Corona virus disease (Covid-19); sebuah tinjauan literatur. *Jurnal Penyakit Dalam Indonesia*. 2020;7(1):187-92.
2. Handayani, D., Hadi, D.R., Isbaniah, F., Burhan, E., Agustin, H. Penyakit virus corona 2019. *Respir Indo*. 2020;40(2):119-28.
3. Susilo, A., Rumende, C.M., Pitoyo, C.W., Santoso, W.D., Yulianti, M., Herikurniawan, Sinto, R. Singh, G. Nainggolan, L. Nelwan, N., Chen, L.K., Widhani, A., Wijaya, E., Wicaksana, B., Maksum, M., Annisa, F., Jasirwan, C.O., Yuniastuti, Y.E. Coronavirus Disease 2019: Tinjauan Literatur Terkini Coronavirus Disease 2019: Review of Current Literatures. *Jurnal Penyakit Dalam Indonesia*. 2020;7(1):45-67.
4. Khasid, R.V., Shidhore, A.A., Kazi, M.M., Patil, S. Awareness of COVID-19 amongst undergraduate dental students in India – A questionnaire based cross-sectional study. *Journal international Journal of Dental Science and Innovative Research (IJDSIR)*. 2020;3(3):90-9.
5. Wang, Z., Qiang, W., Ke, H. A handbook of 2019-nCoV Pneumonia Control and Prevention. China: Hubei Science and technology Press; 2020.
6. Dinas Kesehatan Kota Padang. 2020. <https://dinkes.padang.go.id/covid19>
7. Buana, D.R. Analisis perilaku masyarakat Indonesia dalam menghadapi pandemi virus corona (Covid-19) dan kiat menjaga kesejahteraan jiwa. *SALAM Jurnal Sosial dan Budaya Syar i*. 2020.
8. Entjang, I. Ilmu Kesehatan Masyarakat. Citra Aditya Bakti: Bandung; 2000.
9. Hastjarjo, D. Sekilas tentang kesadaran (consciousness). *Jurnal Buletin psikologi*. 2005;13(2): 90-79.
10. Jha, N. Singh, N. Bajracharya, O. Manandhar, T. Devkota, P. Kafle, S. Shankar, P.R. Knowledge about the COVID-19 pandemic among undergraduate medical and dental students in Lalitpur, Nepal. *Research Square*. 2020. ISSN 2693-5015
11. Kamate SK, Sharma S, Thakar S, et al. Assessing Knowledge, Attitudes and Practices of dental practitioners regarding the COVID-19 pandemic: A multinational study. *Dent Med Probl*. 2020;57(1):11–7.
12. Rajaratnam, S.G., Martini, R.D., Lipoeto, N.I.,. Hubungan tingkat pengetahuan dan sikap dengan tindakan pencegahan osteoporosis pada wanita usia di kelurahan jati. *Jurnal Kesehatan Andalas*. 2014; 3(2) 225-8.
13. Rusuli, I. dan Daud, Z.F.M. Ilmu pengetahuan dari John Locke Ke Al-Attas. *Jurnal Pencerahan*. 2015; 9(1):12-22.
14. Supraja, M. Alfred Schutz: Rekonstruksi Teori Tindakan Max Weber. *Jurnal Pemikiran Sosiologi*. 2012;1(2); 81-90.
15. Siagian, T.H. Mencari kelompok berisiko tinggi terinfeksi virus corona dengan discourse network analysis. *Jurnal Kebijakan Kesehatan Indonesia : JKKI*. 2020; 9(2): 98-106.
16. Shahin, S.Y. Bugshan, A.S Almulhim, K.S. AlSharief, M.S. Dulaijan Y.A. Alqarni, F.D. Knowledge and attitude of dentists, dental auxiliaries, and students regarding the COVID-19 pandemic in Saudi Arabia: A Cross-Sectional Survey. *Research Square*. 2020.
17. Uswatusolihah, U. Kesadaran dan transformasi diri dalam kajian dakwah islam dan komunikasi. *Jurnal Komunika*. 2015; 9(2): 258-75.
18. Puspita, S. dan Rahmalina, W, 2021. Pemodelan Seasonal Autoregressive Integrated Moving Average Untuk Memprediksi Jumlah Kasus Covid-19 di Padang. *Jurnal Matematika Integratif*. 2021; 17(1): 23.
19. Wahidah, I., Septiadi, M.A., M. Rafqie, C.A., Salsabila, N.F., Hartono, R.A., 2020. Pandemi Covid-19: Analisis Perencanaan Pemerintah dan Masyarakat dalam Berbagai Upaya Pencegahan. *Jurnal Manajemen dan Organisasi (JMO)*. 2020; 11(3):179-88.



20. Yunus, N. R., dan Rezki, A. Kebijakan pemberlakuan lock down sebagai antisipasi penyebaran corona virus Covid-19. Jurnal Sosial Dan Budaya Syar-I. 2020; 7(3): 227-38.

Differences of Composite Resin Surface Hardness After Exposure to Filter Cigarette and Electric Cigarette Smoke

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ABSTRACT

Background: Composite resin is a dental filling material that has several mechanical properties, one of which is surface hardness. Surface hardness can increase due to several factors such as smoking habits. Filter cigarette is the second most common type of cigarette in Indonesia and electric cigarette is the third most common type of cigarette in Indonesia. Both types of cigarettes can affect the surface hardness of the composite resin due to a decrease in the pH of saliva produced from cigarette smoke. **Objective:** This study aimed to determine the difference in surface hardness of the composite resin after exposure to filter cigarette smoke and electric cigarette. **Methods:** 27 samples of nanohybrid composite resin were divided into three groups. Group 1 as a control group was immersed in artificial saliva and was not exposed to cigarette smoke, group 2 was the group that was treated with filter cigarette smoke and group 3 was the group that was treated with electric cigarette. Furthermore, the groups were tested for surface hardness using a Vickers hardness tester. **Results:** The surface hardness test of the composite resin showed an increase in the control group and a decrease in the treatment group, with the highest decrease in the filter cigarette smoke treatment group. The results of the paired t-test and one-way ANOVA test showed that the p-value was >0.00 so there was no difference between the pre-test and post-test mean differences in each group and there was no difference between the mean of each group. **Conclusion:** There was no difference before and after exposure to filter cigarette or electric cigarette smoke.

Keywords: Composite Resin Surface Hardness, Electric cigarette, Filter Cigarettes.

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INTRODUCTION

Smoking is still a big problem in Indonesia. According to Riskesdas, the prevalence of smokers increased by 28,8%.¹ there are innovations from conventional smoke, called electric cigarette. Filter cigarettes contain tobacco, nicotine, and TAR which are harmful to both passive and active smokers. Therefore, electric cigarette were created which are claimed to be harmless because of the "HEALTH" label on the packaging.² However, according to Food and Drug Administration (FDA) research in 2009, there are diethylene glycol (DEG) and tobacco nitrosamines (TSNA) are toxic and carcinogenic.³ Electric cigarette are cigarettes in the form of an Electronic Nicotine Delivery System (ENDS), which do not burn tobacco, but the liquid is burned using a battery and the smoke enters the user's lungs.²

Composite resin is a material that is insoluble, insensitive to dehydration, has good aesthetics, and is easy to manipulate.⁴ In the composite resin, there is a bioactive composite that can release phosphate ions, calcium ions, and fluorine ions at an acidic pH which will reduce the activity of protease enzymes as collagen degraders.⁵ Composite resin has four main compositions, namely matrix, filler, coupling agent, and inhibitor.⁶ There are four types of composite resin based on the filler that are macrofilled composite (20-30 m), microfilled composite (0.01-0.1 m and 5-50 m), hybrid composite (0.01-0.1 m), and nanofilled composite (1-100nm). The smaller the particle size of the composite filler, the less the microfissure color, polymerization shrinkage, and changes.⁷

According to Mustakim,⁸ regarding the recency of similar research using acrylic artificial tooth samples, there is a significant change in the color of acrylic artificial teeth after exposure to filter cigarette smoke. The color of acrylic artificial teeth also changed after exposure to electric cigarette smoke, but not significantly. The purpose of this research was to find out and analyze the difference in the level of hardness of

the composite resin after being exposed to filter and electric cigarette smoke. Based on the background of the problem, the focus of this research included changes in the hardness of composite resins after exposure to filter and electric cigarettes, scientific articles that can add scientific references in the field of Dentistry, and information material about the level of danger of filter cigarettes and electric cigarette.

This study aimed to determine and analyze differences in the level of hardness of composite resins after exposure to filter and electric cigarette smoke. The benefits and potential of the research carried out are to provide scientific contributions, especially in the scope of dentistry regarding differences in the surface hardness of composite resins after exposure to filter and electric cigarette smoke, as well as information material for the development of other research with similar topics.

MATERIALS AND METHODS

This research begins with the manufacture of a test object in the form of a composite resin which is molded using a metal ring mold with a diameter of 12 mm and a thickness of 2 mm. The specimens used in this study were 27 samples which were divided into 3 groups, group 1 as a control group that was immersed in artificial saliva and not exposed to cigarette smoke, group 2 as a group treated with filtered cigarette smoke and group 3 as a group treated with smoke electric cigarette.

The sample will be placed in a smoking simulation tool made using a jar for each treatment group, then a hole is made according to the diameter of the cigarette on the lid of the jar. On the left or right side of the jar, a hole is made for inserting the hose and cotton. At the bottom of the jar, a hole is made to insert a catheter syringe that has been separated from the needle. Prior to sample treatment, all samples were immersed in artificial saliva for 24 hours to adjust to the conditions of the oral cavity. The soaked samples, were then stabilized at room temperature for 24 hours. Furthermore,



hardness values were measured before being exposed to filters and e-cigarette smoke using the Micro Vickers Hardness Tester. Measurement of hardness value using a ratio scale with hardness unit measured by Vickers Hardness Number (VHN).

All samples that have been tested for hardness are divided into 3 groups. Group 1 samples were immersed in artificial saliva for 24 hours in 21 days placed in a closed container and the artificial saliva was replaced every day. Groups 2 and 3 samples were arranged in a fumigation simulation tool using red wax so that the composite resin was stable and the position of the composite resin was facing the tip of the cigarette. Composite resin samples that have been well fixed in a smoking simulation tool can be exposed to cigarette smoke.

Exposure to filtered cigarette smoke begins by inserting the tip of the smoked cigarette into the jar to the smoking limit marked by a line circling the cigarette. The tip of the cigarette that is outside the jar is burned using a lighter. The plunger of the syringe is pulled and pushed slowly so that the filter cigarette burns out. After the filter cigarette is completely burned, the plunger of the syringe is pulled slowly as if it were smoking cigarette smoke so that the cigarette smoke can enter the jar in about 3-5 seconds in one puff. Furthermore, the cigarette smoke in the jar is removed by pushing the plunger slowly as if exhaling cigarette smoke from the mouth. The plunger is pulled and pushed until one cigarette runs out which is indicated by the cigarette dying by itself at the smoking limit. After 30 minutes, the cycle is repeated on another cigarette. The number of filter cigarettes smoked in a day is six cigarettes because the average chronic smoker smokes six cigarettes in one day. After all cycles were completed, the samples were immersed in distilled water for 1 minute, then immersed in artificial saliva for 24 hours. After that, the cycle was repeated for 21 days. After all cycles were completed, the samples were immersed in distilled water for 1 minute, then immersed in artificial saliva for 24 hours. After that, the cycle

was repeated for 21 days.

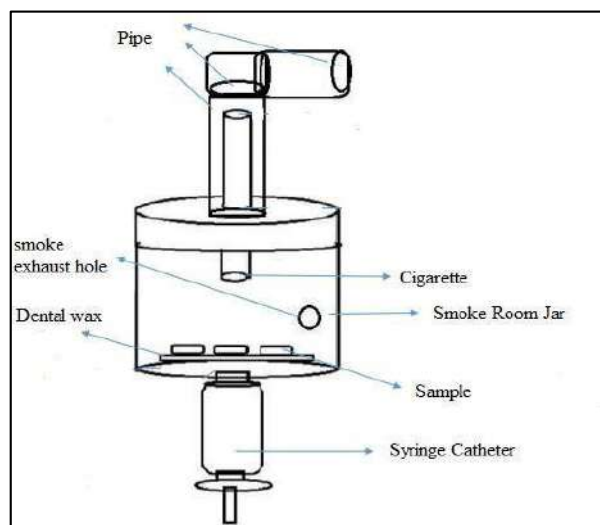


Figure 1. Design of a smoking simulation tool.⁸

Exposure to filter cigarette smoke is done by inserting the tip of the cartridge that is being smoked into a jar. Exposure to smoke is done by gently pulling the plunger of the syringe as if it were smoking cigarette smoke so that cigarette smoke can enter the jar in about 3-5 seconds in one puff. After the cigarette smoke in the jar is removed by pushing the plunger slowly as if blowing cigarette smoke out of the mouth. Pull and push the plunger of the syringe for 3 minutes. After 30 minutes, the cycle was repeated six times. After all cycles were completed, the samples were immersed in distilled water for 1 minute, then immersed in artificial saliva for 24 hours. After that, the cycle was repeated for 21 days.

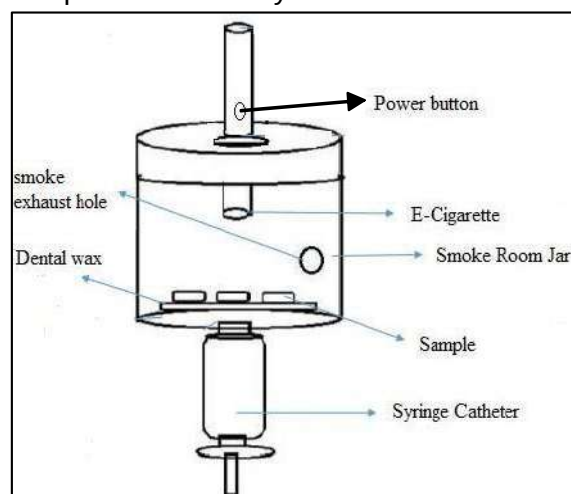


Figure 2. Design of a smoking simulation tool.⁸

After 21 days, all groups were tested for hardness using the Micro Vickers Hardness Tester at the UGM Materials Laboratory. Furthermore, the change in the surface hardness of the composite resin was calculated from the difference between the initial and final hardness measurements. The calculation results are recorded in the Vickers Hardness Number (VHN). The data was processed using the SPSS computer program. Furthermore, the data obtained from the 3 groups were tested for normality and homogeneity. If the data is normally distributed and homogeneous, then the One Way ANOVA parametric test is performed. If the data is not normally distributed, then it is continued with the Kruskal Wallis non-parametric test.

RESULTS

A total of 27 composite resin samples were treated differently in each group, which were group 1 as a control group immersed in artificial saliva, group 2 as a group exposed to filter cigarette smoke, and group 3 as a group exposed to electric cigarette smoke. Each group consists of 9 samples. then the sample was tested for sample hardness using a Vickers hardness tester. The results of the sample hardness test were obtained from three measurements on each sample and then the average hardness test results were taken for each sample so that the following results were obtained:

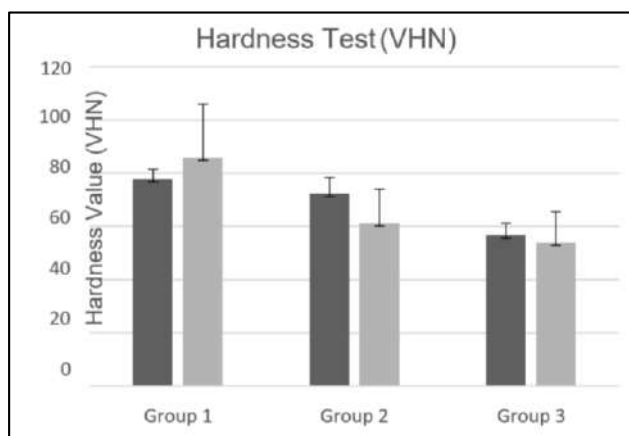


Figure 3. Graph of pretest and posttest results

The test results showed the average value of the surface hardness of the composite resin in each group produced different results. The average composite surface hardness of group 1 increased by 8.03 VHN, group 2 decreased by 11.09 VHN, and group 3 decreased by 2.69 VHN. The average surface hardness of the composites that experienced an increase was in group 1 which was not exposed to cigarette smoke. The average composite surface hardness that experienced the highest decrease was in group 2 exposed to filter cigarette smoke, and the lowest decrease was in group 3 exposed to electric cigarette smoke. The difference in the average surface hardness of the composite before and after treatment was described in the following figure:

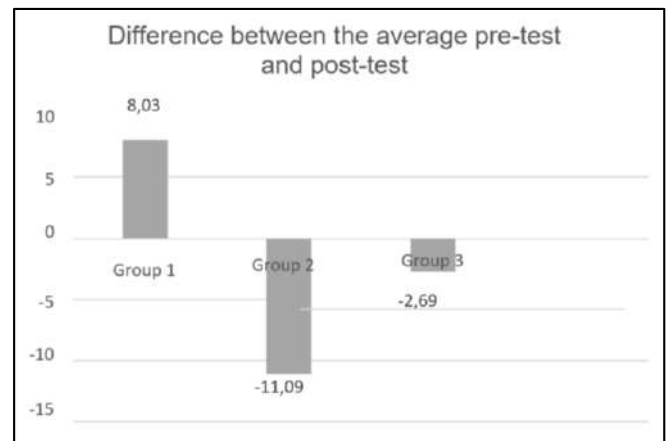


Figure 4. Graph of the average difference between pretest and posttest

The data was then analyzed using Statistical Product and Service Solutions (SPSS) software. The data analysis stage begins with a normality test carried out using Shapiro Wilk because the number of samples is 21 which means less than 50 and the homogeneity test was carried out using the Levene Test. The results show that the data in each group have a $p > 0.05$, which means that the data were normally distributed and homogeneous. Furthermore, a parametric test in the form of a paired t-test was carried out to determine the difference in the average sample before and after treatment in each group, so that the following results were obtained:

Table 1. The results of the Paired Test

No	Group	Average (VHN $\pm$ SB)		P-value
		Pretest	Posttest	
1	1	77,77 $\pm$ 3,74	85,80 $\pm$ 20,16	0,266
2	2	72,20 $\pm$ 6,21	61,12 $\pm$ 12,87	0,071
3	3	56,61 $\pm$ 4,57	53,92 $\pm$ 11,60	0,501

The results of the paired t-test of groups 1, 2, and 3 before and after treatment showed a p-value of more than 0.05, meaning that H0 was accepted and H1 was rejected, where there was no significant difference in the surface hardness of the composite resin, both pretest and posttest in the group. 1, 2, and 3. Then a one-way ANOVA test was conducted to find out whether there were significant differences in each variable, the following results were obtained:

Tabel 2. The results of *One-Way ANOVA*

No	Group	Number of samples	P-value		P value
			Average	SB	
1	1	9	18,77	9,03	0,117
2	2	9	14,28	12,82	
3	3	9	8,52	7,54	

In Table 2. the p-value results were more than 0.05. It meant that H0 was accepted and H1 was rejected so that it can be stated that all variables do not have significant differences.

DISCUSSION

Composite resin is known as one of the materials used for dental restorations. Composite resin has several physical properties, namely polymerization shrinkage, solubility, and air absorption, as well as mechanical properties consisting of flexural strength, modulus of elasticity, roughness, and surface hardness.⁷ Almost all of these composite properties can change after exposure to various substances, both natural and, one of which is exposure to cigarette smoke.

The occurrence of an increase in surface hardness in group 1 in connection with research

conducted by Langen, et al.,⁹ which showed that a number of nanohybrid composite resins immersed in saliva improved the surface quality. This occurs because of a buffer function in saliva which functions to withstand the rise and fall of pH in the oral cavity.¹⁰ The bicarbonate anhydrase enzyme in saliva can catalyze the reaction between free H⁺ ions from bicarbonate ions to produce distilled water and carbon dioxide which will be released into the oral cavity. This causes the salivary pH to slowly return to its normal pH in approximately 30-60 minutes.⁹ Another study conducted by Fitriyana,¹¹ also stated that artificial saliva had an effect in increasing the compressive strength of type II glass ionomer cement soaked in isotonic drinks.¹¹ This is because saliva has a buffering function in the oral cavity and is also self-cleaning for both teeth and dental restorative materials, such as composite resins.

Meanwhile, the decrease in the surface hardness of the composite resin in groups 2 and 3 occurred due to the pH produced by filter cigarette smoke being lower than that of electric cigarettes. The pH of filter cigarette smoke is 6.4 with a range of 5-8, and the pH of electric cigarette smoke is 6.8 with a range of 5-7. This is related to the research conducted by Somayaji, et al.,¹² that composite resins immersed in different acid beverages decreased the hardness of nanohybrid composite resins after 21 days and showed that the lower the pH, the greater the decrease in hardness. These acidic conditions cause a lot of H⁺ ions to be released from their hydroxyl groups that can attack the double bonds of the polymer matrix composite which can cause broken instability. The breaking of the polymer double chain chemical bonds based on the composite resin causes degradation of the composite resin composite which can reduce the surface of the composite resin. The released H⁺ ions can also attack the siloxane as a bond that connects the matrix and filler particles so that it can cause filler particles and composite matrix.^{13,14,15}

Apart from the decrease in pH, a decrease in the hardness of the composite resin

can occur due to the hydrolysis process produced by the heat from cigarette smoke. The heat of cigarette smoke can increase the kinetic energy of air diffusion so that it can increase the absorption of air in the resin composite. The absorbed air will undergo a hydrolysis process so that the air decomposes into H⁺ and OH⁻ due to the presence of O elements in the resin matrix. OH⁻ ions from water can enter the matrix and attack the siloxane (Si-O-Si), which is a link between the matrix and filler particles, so that the siloxane is cut off and silanol compounds (Si-OH) and Si-O are formed. Si-O can react when it meets air because it experiences electron disorientation. The reaction produces Si-OH and OH⁻. OH⁻ breaks the siloxane again and the cycle continues as long as the composite resin is immersed in air. The longer the cycle occurs, the higher the risk of damage to the saline coupling agent which causes the release of filler particles and the composite resin matrix which can reduce the surface of the composite.^{16,17,18}

CONCLUSION

Based on the results of research that has been done, it could be concluded that cigarette smoke has an acidic pH which can reduce the hardness of composite resins. Groups 2 and 3 showed an insignificant decrease in the hardness of the composite resin with the highest mean decrease in group 2. On the other hand, group 1 which was not exposed to filter and electric cigarette smoke and only immersed in artificial saliva showed an increase in the hardness of the composite resin.

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REFERENCES

1. Kemenkes RI. Hasil Utama Riskesdas 2018. Jakarta; 2018. p. 81.
2. Fitriani, K., Mustafa, Z.. Penggunaan Rokok Elektrik (Vape) di Kota Makassar Perspektif Hukum Islam. Jurnal Ilmiah Mahasiswa Perbandingan Mazhab. 2020; 1(2): 114-7.
3. Rohmani, A., Yazid, N., Rahmawati, A. A. Rokok Elektrik dan Rokok Konvensional Merusak Alveolus Paru. In: Prosiding Seminar Nasional Unimus; 2018 (pp 27-32).
4. Puspitasari, S. A., Siswomihardjo, W., Harsini. Perbandingan Kekasaran Permukaan Resin Komposit Nanofiller pada Perendaman Saliva pH Asam. Jurnal Material Kedokteran Gigi. 2016; 2(5): 15-9.
5. Irpansyah, Diana, S., Azizah, A. Pengaruh Minuman Energi dan Susu Fermentasi Terhadap Pelepasan Ion Fosfat dan Fluor Resin Komposit Bioaktif. Dentin Jurnal Kedokteran Gigi. 2020; 4 (3): 116-7.
6. Shen, C., Rawls, H. R., Esquivel-Upshaw, J. F. Philips' Science Of Dental Material. 13th Ed. Missouri. Elsevier; 2022.
7. Rezaie, H.R., Rizi, B.H., Khamseh, M.M.R., Öchsner, A. A. Review on Dental Materials. Switzerland: Springer; 2020.
8. Mustakim, K. R. Pengaruh Asap Rokok Filter dan Elektrik terhadap Perubahan Warna Gigi Artifisial Akrilik [skripsi]. Makassar: Fakultas Kedokteran Gigi Universitas Hasanuddin Makassar; 2016.
9. Langen, E. N., Rumampuk, J. F., Leman, M. A. Pengaruh Saliva Buatan Dan Belimbing Wuluh (Averrhoa Bilimibi L.) Terhadap Kekerasan Resin Komposit Nano Hybrid. Jurnal Ilmiah Farmasi. 2017; 6(1): 9-15.
10. Wirawan, E., Puspita, S. Hubungan pH Saliva dan Kemampuan Buffer Dengan DMF-T Dan def-t Pada Periode Gigi Bercampur Anak Usia 6-12 Tahun. Insisiva Dental Journal. 2017; 6(1): 25-30.
11. Fitriyana, D. C. Uji Pengaruh Saliva Buatan Terhadap Kekuatan Tekan Semen IonomerKaca



- Tipe II Yang Direndam Dalam Minuman Isonik. 2014; 2(2).
12. Somayaji, S. K., Amalan, A., Ginjupalli, K. Effect of Different Acidic Beverages on Microhardness of Nanohybrid Composite, Giomer, and Microhybrid Composite. *World Journal Dental*. 2016; 7(3): 126-8.
 13. Ikhsan, N., Kasuma, N., Kustantiningtyastuti, D. Perbedaan Kekerasan Permukaan Bahan Restorasi Resin Komposit Nanofiller yang Direndam dalam Minuman Ringan Berkarbonasi dan Minuman Beralkohol. *Andalas Dental Journal*. 2016; 4(1): 55-66.
 14. Dewi, N. N. S. S. S. L., Pertiwi, N. K. F. R. Perbedaan Tingkat Kekerasan Permukaan Mikrofiller Resin Komposit Dan Nanofiller Resin Komposit Setelah Direndam Larutan Kopi. *Bali Dental Journal*. 2020; 4(2):104-8.
 15. Sitanggang, P., Elita, T., Jane, W. Uji Kekerasan Komposit Terhadap Rendaman Buah Jeruk Nipis (*Citrus Aurantifolia*). *Jurnal e-Gigi*. 2015; 3(1).
 16. Noort, R.V., *Introduction to Dental materials*. 4th ed. Contact Dermatitis. China. Elsevier B.V. 2013.
 17. Chandra, J., Setyowati, L., Setyabudi. Kekasaran Permukaan Resin Komposit Nanofiller dan Nanohybrid Setelah Paparan Asap Rokok Kretek. *Conservative Dentistry Journal*. 2018; 8(1): 30-5.
 18. Thomas, C. A. Pengaruh Asap Rokok Elektrik (Pod) Terhadap Kekasaran Permukaan Resin Komposit Nanohybrid [skripsi]. Jakarta: University Of Trisakti; 2021.



Effect of Nutmeg (*Myristica Fragrans*) Methanolic Extract to the Growth of Dental Plaque Bacteria

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ABSTRACT

Background: One of the causes of dental caries is *Streptococcus mutans* bacteria which has the ability to change the sugar content of food waste into lactic acid as the initial process of caries. One of the efforts to overcome dental caries is to use natural ingredients such as nutmeg. Every part of nutmeg has active substances that are efficacious as antimicrobial, antibacterial, antioxidant, antifungal and anti-inflammatory. Pulpam, seeds and fulli of nutmeg showed as potential extracts in inhibiting the growth of *Streptococcus mutans*. **Objective:** This study aimed to analyze methanol extracts from pericarpium, pulpam, fulli and nutmeg seeds against the growth of *Streptococcus mutans* bacteria that causes dental plaque. **Methods:** The research was conducted by diffusion method using BHI agar media and incubated anaerobically at 37°C for 24 hours. **Results:** The results of the calculation of the average diameter of the inhibition zones from the extract of fulli, seeds, pulpam and pericarpium of the nutmeg plant were 19.00 mm, 25.33 mm, 15.66 mm, 22.66 mm, and 21.83 mm, respectively. Data analysis using ANOVA (one way) showed that there were significant differences in all groups at $p < 0.05$. The results of the LSD test showed that there were significant differences in all treatment groups. **Conclusion:** Methanol extract from fruit and fruit parts of nutmeg showed the ability to inhibit the growth of bacteria that cause dental plaque.

Keywords: Dental Plaque, *Myristica Fragrans*, Bacteria, *Streptococcus mutans*, Dental Caries

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INTRODUCTION

Dental and oral health problems, especially dental caries, are a disease that affects almost half of the world's population. The results of the Basic Health Research (Riskesdas) in 2018 stated that the prevalence of caries in Indonesia was 88.8%.¹ In realizing a caries-free Indonesia by 2030, Ministry of Health in preparing strategic plans and action plans for dental and oral health efforts, one of them is the implementation of dental and oral health efforts.²

Many efforts have been made to support dental health services, especially to prevent and overcome dental caries problems, one of them is research on natural ingredients to be used as medicines. The use of natural ingredients as medicine causes very few adverse side effects compared to synthetic drugs.^{3,4} One of the plants that has the potential to overcome disease and health problems is spices.⁵ Several studies have shown that spices have antimicrobial properties. The main component that gives spices antimicrobial properties is the essential oil. Essential oils are also known as volatile oils or etheric oils and are sometimes referred to as spice oils.⁶

Nutmeg (*Myristica fragrans* Houtt) is one of Indonesia's original spices that has economic value and multipurpose because every part of this plant can be used in various industries such as the food industry, medicine and cosmetics.⁷ Nutmeg is one of the important export commodities for Indonesia, because Indonesia is the largest exporter of nutmeg seeds and *fuli* (mace), which is around 60% of the world's nutmeg needs.⁸ Fuli is a seed coat or a thin, bright red membrane that covers the skin of the nutmeg which is often referred to as mace or many also call it mace. Nutmeg production in West Sumatra from 2008 to 2013 has a tendency to increase. Nutmeg production in West Sumatra in 2013 was around 1,332 tons and the land used was 3,683 Ha.⁹

Nutmeg consists of four parts namely *pericarpium*, *pulpam*, *fuli*, and seeds. All parts of the nutmeg can be used for various purposes,

among which the best known in the market are *fuli* and seeds as spices, while nutmeg oil is usually used for medicine.¹⁰ Nutmeg contains common compounds such as carbohydrates, proteins, structural fats, and minerals (potassium, magnesium and phosphorus), especially essential oils which have high economic value.¹¹ In addition, every part of the nutmeg has an active substance as an antimicrobial substance¹² antibacterial, antioxidant, antifungal, and anti-inflammatory.^{13,14,15}

Nutmeg contains anti-inflammatory properties, is rich in monoterpenes such as terpineol, pinene and sabinene. All of these substances are anti-inflammatory compounds that can prevent inflammation, Besides having antioxidant properties, Nutmeg shows some anti-bacterial effects, especially against some harmful bacteria such as *Streptococcus mutans* which is one of the bacteria that causes dental caries.¹⁶ Nutmeg seeds and fruit contain saponins as antibacterial, essential oils are oils produced by one of the metabolic processes that contain trimyristin and myristicin as antioxidants, anti-inflammatory and antibacterial.¹⁷ Nutmeg seeds produce a special etheric oil and fat.

Other supporting data is a study conducted by Shafiei Z et al (2012) on the antibacterial activity of nutmeg against oral cavity pathogens. The results showed that the active compound trimyristin contained in nutmeg functions as an antibacterial against gram-positive bacteria such as *Streptococcus mutans*, *Streptococcus sobrinus* and *Lactobacillus*. These bacteria are thought to be bacteria that can cause dental caries. Meanwhile, gram-negative bacteria such as *Aggregatibacter actinomycetemcomitans*, *Porphyromonas gingivalis*, are closely associated with periodontitis.¹⁸ Other research on invitro antimicrobial activity of phytochemical extract of *Myristica fragrans* on *Streptococcus mutans* stated that the ethanol extract of the pulp, seeds and *fuli* of nutmeg showed a strong potential against the pathogen *Streptococcus mutans*.¹⁹

Preliminary test results from the author show that gargling with nutmeg powder causes a fresh taste in the mouth. Based on the description of the background above, the author is interested to analyze extracts from *pericarpium*, *pulpam*, *fuli*, and nutmeg seeds against the growth of *Streptococcus mutans* bacteria that causes dental plaque.

MATERIALS AND METHODS

Materials and apparatus

The materials used in this study are Fruit and fruit parts of nutmeg (*pericarpium*, *pulpam*, *fuli*, and seeds) obtained from the Bukittinggi area. West Sumatra, *Streptococcus mutans* culture (collection from the Bacteriology Laboratory of the Faculty of Medicine of Andalas University), *Brain Heart Infusion Broth* (BHI) media, 70% ethanol, methanol, distilled water, McFarland 0.5. The tools used include Petri dishes, test tubes, centrifuges, shakers, autoclaves and incubators

Preparation of nutmeg extract

Fruit and fruit parts of nutmeg (*pericarpium*, *pulpam*, *fuli*, and seeds) were washed and dried in the oven at 40°C for 48 hours, then powdered by using electrical blender and ready to extract by maceration methods. 25 grams of Each of powder the fruit and parts of the nutmeg (*pericarpium*, *pulp*, *mace*, and seeds) dissolved with 150 ml methanol solvent in a erlenmeyer then macerated for 72 hours and shaking periodically. The precipitated residue was separated from the solvent by filtration and concentrated by using vacuum evaporator at 50°C to produce a crude extract. The crude extract extracted again twice with 150 ml solvent to obtain a clear colour residue..

Evaluation of antimicrobial activity

S. mutans strains were grown in brain heart infusion (BHI) broth (Difco, Detroit, MI, USA) or on BHI agar plates overnight at 37 °C in 95% air and 5% CO₂ (v/v). Disk diffusion method was used to measure *S. mutans* sensitivity to the

experimental group consisting of Fruit and fruit parts of nutmeg (*pericarpium*, *pulpam*, *fuli*, and seeds). Thirty mL of freshly prepared and autoclaved brain heart infusion (BHI) agar was poured into sterile glass petri dishes. The media were cooled to room temperature, and stored in a refrigerator until use. Plates were examined for sterility before use by incubating at 35 °C for 48 h. Three to five well isolated colonies of the same morphological type were selected from a blood agar plate culture and transferred with a sterile loop into a tube containing 5 mL of BHI broth that was then incubated at 37 °C for 24 h. The turbidity of the broth culture was adjusted to 0.5 McFarland standards. Transferred immediately 50 µL of the broth to the middle of a dry BHI agar and spread uniformly over the entire agar surface using a sterile L spreader. Filter paper discs of 6 mm diameter were prepared from Whatman filter paper No. 1, placed in a petri dish and sterilized in a hot air oven at 160 °C for 2 h. Thereafter, discs were impregnated with 20 µL of each of the experimental groups (*pericarpium*, *pulpam*, *fuli*, and seeds), 3 disks for each group, and placed immediately over the plates. Sterile distilled water were used as negative control. The plates were incubated for 24 h at 37 °C. After incubation, the plates were observed for uniform culture growth (granular, frosted glass appearance) and formation of inhibition zones around the discs that were measured in millimeters. The mean of 3 measurements of the diameter of each inhibition zone for each disk was calculated. The test was repeated twice for accuracy

DATA ANALYSIS

Data was analyzed using SPSS 15.0 for windows (SPSS Inc, Chicago, IL, USA, 2001). One-sample Shapiro Wilk test was used to assess the normality of data distribution. One-Way ANOVA was used to compare the antibacterial effect of Fruit and fruit parts of nutmeg (*pericarpium*, *pulpam*, *fuli*, and seeds). Least Significant Difference (LSD) test was

performed to determine the difference in significance between each group.

RESULT

The results of the study were the calculation of the mean diameter and standard deviation of the inhibition zone of the extract from each part of the sample on the growth of *Streptococcus mutans*.

Table 1. Average results of inhibition zone of extract

Extract group	N	Average inhibition zone $\pm$ SD
Fuli	3	19 $\pm$ 2
Seed	3	25,33 $\pm$ 2,08
Pulpam	3	15,66 $\pm$ 1,52
Pericarpium	3	22,66 $\pm$ 1,52
Fructus	3	21,83 $\pm$ 0,28
Negative control (DMSO)	3	0
Total	18	104.5 $\pm$ 7.42

Based on the research data (Table 1), it was obtained data that there was a clear zone (inhibition) of the nutmeg extract and the part of the nutmeg on the growth of *Streptococcus mutans* bacteria. while the negative control (Sterile distilled water) did not give a clear area. The smallest inhibitory power was produced by the pulp extract of 15.66 mm and the largest inhibition was produced by the nutmeg seed extract of 25.33 mm. From Figure 1 below, it can be seen that the seeds have a higher inhibitory diameter than the fruit and other parts.

The ANOVA test results show that there are significant differences in each test group at $p < 0.05$. Based on the results in table 1, it can be concluded that the extract of the fruit and parts of the fruit can inhibit the growth of *Streptococcus mutans* bacteria and needs to be continued with the LSD test.

Table 2. LSD test results

Extract group	Mean
Fuli	19 ^a
Seed	25,33 ^b
Pulpam	15,66 ^c
Pericarpium	22,66 ^d
Fructus	21,83 ^d

The LSD test results in table 2 above show that there is a significant difference between Fuli on seeds, pulp, pericarpium, and fruit. Likewise, Seeds have a significant difference with other parts. Meanwhile, there is no significant difference between the pericarpium and the fructus.

DISCUSSION

Nutmeg and parts of the nutmeg which include pericarpium, pulpam, fuli, and seeds according to preliminary test, contain active compounds of essential oils and other common chemical compounds found in fruit such as carbohydrates, proteins, structural fats, and minerals. fuli and seeds of nutmeg have the ability to inhibit the growth of Gram Negative and Positive bacteria. Meanwhile, according to previous research, nutmeg seeds contain phenols, terpenoids, flavonoids and alkaloids that have antibacterial activity.²⁰ In addition, the essential oils and saponins found in the pulpam of nutmeg are also antibacterial substances. Antibacterial substances in fuli of nutmeg include flavonoids, phenols, saponins and tannins which are also able to inhibit bacterial growth. The results of other studies also provide information that the pulpam of nutmeg also contains phenolic compounds and antioxidants that have potential as antimicrobials.²¹ Each active substance contained in nutmeg and other fruit parts has a specific mechanism of action in carrying out its function as an antibacterial. Flavonoids will form complex compounds with extracellular proteins to damage bacterial cell membranes. Flavonoids also play a role in inhibiting energy metabolism. Flavonoid compounds will interfere with energy metabolism, where sufficient energy is needed for the absorption of various metabolites and for macromolecular biosynthesis.²² Phenolic compounds and antioxidants are able to inactivate the development of oxidation reactions by preventing the formation of free radicals that attack macromolecular components such as proteins, lipid membranes and DNA that

cause diseases such as cancer, diabetes mellitus and inflammation.²³

The results of the study as shown in table 1 showed the inhibitory ability of extracts of Fruit and fruit parts of nutmeg (*pericarpium*, *pulpam*, *mace*, and *seeds*) against *Streptococcus mutans* bacteria. This is evidenced by the formation of a clear zone around the filter paper disc Fruit and fruit parts of nutmeg extract (*pericarpium*, *pulpam*, *mace*, and *seeds*). The inhibition zones formed were generated from each Petri dishes that have different diameter sizes and non-uniform shapes. Therefore, measurements were made by measuring the vertical diameter and horizontal diameter of the zone inhibition formed around the filter paperdisc. Table 1 shows that the petri dish containing the seed extract has the largest inhibition zone diameter of 25.33 mm and the petri dish containing the pulp extract has the smallest inhibition zone of 15.66 mm. The description of the calculation results is inserted into the diagram to see the size of the comparison between the intervention group and the control group.

Nutmeg seed extract produced the greatest inhibition compared to other parts of the fruit, even compared to the whole fruit. This is due to the influence of the content of the extracted active compound and the concentration of the test material. The concentration of the test substance can affect the molecular weight to be greater so that the viscosity is thicker. Research by Katalinic *et al.* 2006 showed that the essential oil contained in nutmeg seeds has strong antioxidant properties. The high antioxidant activity occurs due to the synergism between the components of the essential oil.²⁴ Nutmeg seeds contain active compounds such as 5-Octadecanoic acid, myristicin, phenol, terpeneol, and 9-octadecenoic in large enough quantities.²⁵ Extracts from nutmeg seeds also have antioxidant activity from the alkaloid group and vitamin C.²⁶

Strptococcus mutans is a bacterium that has the ability to resist almost all anti-septic drugs. These bacteria have the ability of intrinsic

resistance and acquired resistance. Intrinsic resistance is a characteristic present in almost or all strains of the species in which the gene for intrinsic resistance is carried on the chromosome. Meanwhile, acquired resistance is resistance that is obtained due to DNA mutations or the formation of new DNA through plasmid transfer and transposons. The resistant genes in these bacteria are stored in plasmids so they can be transferred at any time. With this resistance *Streptococcus mutans* bacteria can be resistant to many substances, it is assumed that *Streptococcus mutans* bacteria also have the possibility of being resistant to nutmeg extract because of the same mechanism of action based on phenol content. This study showed that extracts of Fruit and fruit parts of nutmeg (*pericarpium*, *pulpam*, *mace*, and *seeds*) had inhibitory power against *Streptococcus mutans* bacteria, because there were compounds that functioned as antimicrobials against *Streptococcus mutans* bacteria so that breadfruit leaves. In the future research, this plant extract can be developed and processed into medicinal preparations or mixed ingredients in toothpaste and mouthwash to treat dental caries and other oral infections.^{26,27,28}

CONCLUSION

In conclusion, our results indicated that fruit extract and fruit parts of nutmeg has an inhibitory effect on the growth of *Streptococcus mutans* as bacteria that cause dental plaque compared to negative control

REFERENCES

1. The Ministry of Health. Basic Health Research. Indonesian Ministry of Health Research and Development. 2018;53(9).
2. Dewi R kumala, Firdaus IWAK, Hakim AQ. Empowerment of Kaporagi in Reducing the Incidence of Tooth Caries in Toddlers in Wetlands. Proceedings of the National Conference on Community Service and Corporate Social Responsibility (PKM-CSR). 2020; 3 .



3. Mujadi ATF. Inhibition of caries in pediatric patients. Evaluation of Fluorine Application Method (NaF) One Visit at the Dental Clinic Poltekkes Yogyakarta Ministry of Health on Caries Inhibition in Pediatric Patients, Journal of Oral Health Care. 2014; 1(1):.
4. Noviyandri PR, N, Chismirina S. Effect of Nutmeg Flesh (*Myristica fragrans* Houtt) against *Streptococcus mutans* Growth. J Syiah Kuala Dent Soc. 2021; 5(1): 1-5.
5. Thomas A. Traditional Medicinal Plants. Yogyakarta: Kanisius Publishers; 2007.
6. Widodo Santoso A, Simamora A, Simamora A, Herawan Timotius K, Herawan Timotius K. Bioactivities of Water Extract and Essential Oil from the Mace of *Myristica fragrans* Houtt. J Kedokt Yars. 2018; 26(2).
7. Winarti C, Nurdjanah N. Opportunities for Spice and Medicinal Plants as a Source of Functional food. Journal of Agricultural Research and Development. 2005; 24(12): 47-55.
8. Hafif B. The Strategy to Maintain Indonesia as a Main Nutmeg Producer in the World. J Penelit dan Pengemb Pertan. 2021;40(1).
9. Statistics Indonesia West Sumatra. the Central Bureau of Statistics West Sumatera. 2016.
10. Al-Bataina BA, Maslat AO, Al-Kofahi MM. Element Analysis and Biological Studies on Ten Oriental Spices Using XRF and Ames Test. J Trace Elem Med Biol. 2003;17(2).
11. Panggabean KA, Rusmarilin H, Suryanto D. The Utilization of Nutmeg Seed (*Myristica fragrans* Houtt) Extract as an Antimicrobial on Tempeh Sausage. In: IOP Conference Series: Earth and Environmental Science. 2019.
12. Satria WP. Archipelago Herbal Book: Various Recipes & Medicinal Plants For Various Health Disorders. Kata Hati. Yogyakarta. 2015.
13. Gilani SJ, Taleuzzamana M, Jahangirb A. Quantification and Identification of Bioactive Eugenol in *Myristica fragrans* Seed Using Validated High Performance Thin Layer Chromatography Technique. Pharm Anal Acta. 2017; 8(10).
14. Guntur G, Harlia H, Sapar A. Identification of Essential Oil Components of Nutmeg Flesh (*Myristica Fragrans* Houtt.) from Lemukutan Island and Anti-Inflammatory Activity Test Using the Membran Stabilization Method of RBCs (Red Blood Cells). Al-Kimia. 2019;7(2).
15. Gratia B, Yamlean PVY, Mansauda KLR. Toothpaste Formulation Ethanol Extract of Nutmeg (*Myristica fragrans* Houtt.) Pharmacol. 2021;10(3).
16. Rumopa PME, Awaloei H, Mambo C. Inhibition Test of Nutmeg Seed Extract (*Myristica fragrans*) Against the Growth of *Staphylococcus aureus* and *Streptococcus pyogenes* Bacteria. Journal of e-Biomedicine. 2016; 4(2).
17. Ismiyarto I, Ngadiwiyan N, Mustika R. Isolation, Identification of Nutmeg Fuli Essential Oil (*Myristica fragrans*) and Activity Test as a Larvicide. Journal of Science and Application Chemistry. 2009; 12(1): 23-30.
18. Shafiei Z, Shuhairi NN, Md Fazly Shah Yap N, Harry Sibungkil CA, Latip J. Antibacterial Activity of *Myristica Fragrans* Against Oral Pathogens. Evidence-Based Complement Altern Med. 2012; 2012.
19. Setty J, Srinivasan I, Sathiesh R, Kale M, Shetty V, Venkatesh S. In vitro Evaluation of antimicrobial effect of *Myristica fragrans* on Common Endodontic Pathogens. J Indian Soc Pedod Prev Dent. 2020; 38(2).
20. Arrizqiyani T, Sonjaya N, Asty A. Optimizing the Potential of Nutmeg as Antibacterial *Escherichia coli* Using the Extraction Method. Proceedings of the National Seminar. 2017 September; 375-82.
21. Shan B, Cai YZ, Brooks JD, Corke H. The in Vitro Antibacterial Activity of Dietary Spice and Medicinal Herb Extracts. Int J Food Microbiol. 2007;117(1).
22. Cushnie TPT, Lamb AJ. Antimicrobial activity of flavonoids. International Journal of Antimicrobial Agents. 2005; 26.
23. Ngo DH, Vo TS, Ngo DN, Wijesekara I, Kim SK. Biological Activities and Potential Health Benefits of Bioactive Peptides Derived from Marine Organisms. International Journal of Biological Macromolecules. 2012; 51.
24. Katalinic V, Milos M, Kulisic T, Jukic M. Screening of 70 Medicinal Plant Extracts for Antioxidant Capacity and Total Phenols. Food Chem. 2006; 94(4).
25. Ginting B, Mustanir M, Helwati H, Desiyana LS, Eralisa E, Mujahid R. Antioxidant Activity Of n-Hexane Extract of Nutmeg Plants from South Aceh Province. J Nat. 2017;17(1).
26. Fitra Suloi A, Nur A, Suloi F. Nutmeg (*Myristica fragrans* Houtt) Bioactivity : Scientific Review Journal of Agricultural Processing Technology. 2021; 3(1): 11-8.



27. Kim M, Jeon J, Kim J. Streptococcus mutans Extracellular DNA Levels Depend on the Number of Bacteria in a Biofilm. Sci Rep. 2018; 8(1).
28. Silva CB da, Mendes MM, Rodrigues BR, Pereira TL, Rodrigues DBR, Rodrigues Junior V, et al. Streptococcus mutans Detection in Saliva and Colostrum Samples. Einstein (Sao Paulo). 2019;17(1).

E-Knowledge Module Development with Sprint Method in Dr. Ramelan Navy Hospital

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ABSTRACT

Background: Hospitals need to manage document systems well. Dr Ramelan Navy hospital only 15% of the training materials have been documented. Knowledge of basic infection control programs only reached 57.2% and effective communication reached 56%. **Objective:** The purpose of this study is to analyze the factors causing the documentation of training materials under the standard, to determine solutions to improve the documentation of training materials to reach the standard and to develop an activity plan in overcoming the problem of documentation of training materials that have not reached the standard. **Methods:** This study uses the analytical observational method. The method used is the Problem Solving Cycle (PSC) approach. Data obtained through interviews, observations, and documentation in several departments and work units, then processed through a number of stages in overcoming the problem of documentation of training materials. Problems are solved by using a problem solving cycle approach with five stages of problem analysis, strategy design, development strategy, implementation, monitoring, evaluation and feedback. Solution of problems with the development of knowledge modules in hospital management information system. **Results:** The results at the strategy development stage of the development of the module named E-Knowledge was developed using the Sprint method with five stages of map, sketch, divide, prototype and test. **Conclusion:** E Knowledge increase knowledge and improve personnel performance.

Keywords: Problem solving cycle, E knowledge, Sprint method

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INTRODUCTION

Dr. Ramelan Navy Hospital is a public health service provide managed the Indonesian Navy. The hospital has the main task of providing health services and health support to members of the Indonesian Navy and their families as well as serving general patients, with the vision of becoming the primary hospital of choice for the TNI and the community. Efforts to achieve this vision must be able to provide excellent quality health services based on patient needs and satisfaction.

In organizational systems such as hospitals which are very complex, several problems, so there needs to be optimal handling to formulate an appropriate solution. Problem solving cycle (PSC)¹ which is carried out in stages through certain phases, it can help management within an organization to identify problems so need the right solution can then be found.

The results of the analysis of the problems and based on the results of observations, document reviews and interviews with several department officer and section officer, can identify problems in the emergency departement, infection prevention and control committee, outpatient, education and training units and problems related to infrastructure. After determining priorities using the CARL method² (Capability, Accessibility, Readiness, Leverage) it is concluded that external training in 2019 has only been documented 15% of the standard 100%.

The problem is that the training knowledge documentation system (E knowledge)^{3,4,5} has not been managed properly. This is shown by the results of a questioner which shows the level of knowledge of personnel about basic infection prevention and control and effective communication in 2020 is still below the standard.

The purpose of this study is to analyze the causes of the documentation of training materials that have not reached the standard, determine solutions, and develop an activity plan

in overcoming the problem of documentation of training materials.

MATERIAL AND METHODS

This study use the analytical observational method. Data collection through document tracing and interviews with officers in related units. The method used is the Problem Solving Cycle (PSC)^{1,4} approach which consist of five stages. First stage is to determine problem analysis. In conducting a problem analysis there are three activities that must be carried out i.e. problem determination, determination of cause of the problem and priority causes of problem. Problem determination in the unit were obtained through brainstorming with several department officier and section officier, total of them fifteen people. The priority of the problem using the CARL method (Capability, Accessibility, Readiness, Leverage) by giving a score or value for each criterion on the problem list. Scoring is based on mutual aggrement on the value of 1 to 10 CARL criterion (C x A x R x L). Furthermore, priority determination is based on the ranking results. Determination of the cause of the problem is finding the cause of the problem through fish bone method consist of four aspects of Man, Method, Machine, and Materials. Priority causes of problems is to analyze the priority of causes using the CARL method.

Second stage is to determine strategy design. At this stage determine alternative solutions to solve the problem. In solving the problem, it is carried out in stages according to its potential. At this strategy design stage, the steps for compiling alternative solutions are discussed, and then prioritized alternative solutions are carried out. The researcher and staffs conduct discussions in determining alternative solutions documentation of training materials through the CARL method.

Third stage is strategy development. At this stage, the priority of alternative solutions is the development of the knowledge documentation module at hospital management

information system using the sprint technique with 5 stages : map, sketch, decide, prototype and test. Researcher conducted a survey on the identification of module development according to the needs of Ramelan Navy Hospital with on line questionnaire was filled out by fifty nurses from each unit. Fourth stage is implementation, monitoring and evaluation. This research is only up to the implementation stage of module development E knowledge, has not yet the stage of monitoring and evaluation, and fifth stage is follow up and feedback.

RESULTS

Based on the CARL method, result of this study are consist of problem determination, determination of the cause of the problem, priority causes of the problem, strategy design and strategy development. Problems in the unit were obtained through brainstorming with several department officer and section officer. Then the priority of the problem is determined using the CARL method in table 1.

Table 1. Identification of Problems in Ramelan Navy Hospital 2020

Problem	C	A	R	L	Total	Ranking
The waiting time for emergency room patients to outpatient is still long.	8	7	7	8	3136	II
The assessment of compliance with Hand hygiene personnel carried out by IPCNs cannot be maximized in the pandemic era (still using paper, not yet based on Android).	5	6	6	8	1440	IV
The registration flow is not in accordance SOP for outpatient registration	5	7	8	8	2240	III
External training in 2019 totaled 90 trainings, 15% documented training materials with 100% standards	8	9	9	8	51284	I
Incomplete sign for the place/room	5	6	6	7	1439	V

Based on table 1, the problem with the highest priority ranking in the education and training unit is that the external training material documentation standard has not been achieved, 15% from 100%.

After the priority of the problem has been determined, the next step is to identify the cause of the problem. The approach used to obtain the

risk factors that influence the occurrence of the problem is the fishbone diagram analysis method⁶ in Figure 1. Based on Figure 1, information is obtained that the factors causing the documentation of training materials have not reached the standard by covering four aspects; Man, Method, Machine and Materials.

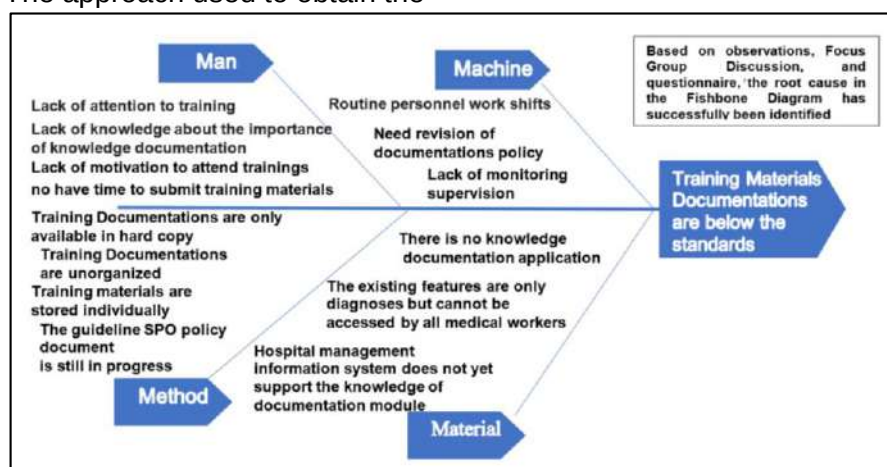


Figure 1. The root cause of training materials documentations that below the standard

Table 2. Priority Causes of Problem

Alternative Solution	C	A	R	L	Total	Ranking
Development of documentation module for training materials at SIMRS	8	9	9	8	5184	I
Development of training material documentation modules on the website	7	8	9	8	4032	II
There is an application / training documentation module in the training unit	6	7	7	8	2688	III

The priority causes using the CARL method can be studied in table 2. Table 2 shows that the priority of causes is based on ranking using the CARL method,, there is no training material documentation module.

Discussions in determining alternative solutions were conducted between researchers and related staff. Alternative solutions provided by the team include: development of training

material documentation module at hospital management information system,^{7,8} development of training material documentation modules on the website and application / training documentation module in the training unit. This stage is to determine the priority of alternative solutions in overcoming the problem of knowledge management which is considered appropriate, effective and efficient in table 3.

Table 3. Priority of Alternative Documentation Solutions Training Materials at Ramelan Navy Hospital 2020

Alternative Solution	C	A	R	L	Total	Ranking
Development of documentation module for training materials at SIMRS	8	9	9	8	5184	I
Development of training material documentation modules on the website	7	8	9	8	4032	II
There is an application / training documentation module in the training unit	6	7	7	8	2688	III

Based on table 3, the priority of alternative solutions is the development of a documentation module for training materials at Ramelan Navy Hospital System Information Management.

At the strategy development stage, the researcher prepares a strategic plan in the development of the module. This module development strategy is the result of discussions with Departement Information Technology team using the Sprint method⁹ in Figure 2.

Stage 1. Map

1. Identify long-term goals
2. Determine the target to be achieved
3. Determine responsible personnel (PIC) in module development

Stage 2. Sketch

4. Designing the documentation module
5. Define use cases

Stage 3. Decide

6. Determine the design of the knowledge documentation module

Stage 4. Prototype

7. Collaborating with the IT team in making prototypes

Stage 5. Test

8. Presenting prototype trials to PIC
9. Facilitate PIC in uploading documents (training prototype)
10. Documenting suggestions for improvement of the prototype from the PIC

Figure 2. Strategy for developing the E Knowledge Module on Hospital System Information Management^{10,11}

The initial step in achieving the objectives of module development: researchers conducted a questionnaire survey on the identification of module development according to the staff

needs of. Dr. Ramelan Navy Hospital. Information obtained from the questionnaire survey is shown in table 4.

Table 4. Features of Module Development at Dr. Ramelan Navy Hospital 2020.

Features	Percentage	Rating
Knowledge documentation / articles	58.8%	1
Discussion forum	27.5%	4
Document search/search knowledge / articles	37.3%	3
Mailing lists	3.9%	8
Download / upload documents (document management)	41.2%	2
Database contains experiences about solving cases with solutions that have been achieved	19.6%	5
Chatting / video conference	13.7%	6
Others	5.9%	7

Based on table 4, it can be seen that the features to be developed according to personnel needs are that personnel need knowledge/article documentation features, download/upload document management and search for knowledge documents. Information on the results of the questioner regarding module development was discussed with Information Technology team, so that the module to be developed was named "E-Knowledge"¹² which not only contained training materials but contained knowledge content needed by personnel. Knowledge content consists of four categories in the form of regulations, training materials, references and journals. Determine the target to be achieved in the development of this module are all training materials are well documented 100% and the level of personnel

knowledge about accreditation material reaches 80%. Fourteen PICs were appointed to represent the professions responsible for managing the E Knowledge module.

DISCUSSION

The PSC method consists of 5 stages, include: (1) Problem Analysis, (2) Strategic Design, (3) Strategy Development, (4) Implementation, Monitoring, Evaluation, and (5) Feedback. The problem analysis stage has three stages, namely determining the problem, determining the cause of the problem and determining the priority of the cause of the problem at Dr. Ramelan Navy Hospital. To properly identify the problem, an evidence-based approach or accurate data is used, so that

it can give confidence to hospital personnel, and believe that it is really a problem. Identify the problem at Dr.Ramelan Navy Hospital is obtained by examining secondary data in the form of quantitative data and/or qualitative data, enter and report data/information from other sectors or sources, focusing on issues refers to accreditation standards and discuss (brainstorming) with the official in charge of the relevant unit.

It was found that the problem was that 15% of 100% of external training material documentation standards had not been achieved. The causes of the problem are various factors related to the problem of managing the documentation of training materials. To identify risk factors, it is necessary to process the root causes of problems in a systematic way and based on data/facts, theories or concepts as well as logic thinking. After knowing the priority of the problem, then brainstorming is continued to find the cause of the problem with root cause analysis. The root cause of the problem consists of 4M (machine, method, material and man). The results of the root cause analysis are as illustrated in Figure 1. From the aspect of various causes of problems, a scoring is carried out using the CARL method to determine the priority of the causes of the problem so that it can be concluded that the priority of the cause of the problem is that there is no documentation module for training materials.

The strategy design stage is the second stage in the problem-solving cycle, which is to determine alternative solutions to solve the problem. In solving a problem, it is carried out in stages according to its potential. At the strategy design stage, the steps for preparing alternative solutions are discussed in solving a problem. There are three alternative solutions that were decided in the discussion, namely the development of a training material documentation module at hospital management information system¹², the development of a training material documentation module on the website. and the development of an application / training documentation module at the education

and training unit. The priority of alternative solutions is determined based on scoring using the CARL method which is the priority, namely the development of the documentation module.

In the strategy development stage, the development of the E-Knowledge module¹³ is adjusted to the allocation of resources, time, and finance. From the allocation of resources, there are no obstacles because the personnel who will later spearhead the success of the E-Knowledge module are carried out with responsibilities in units and professions and are involved in fulfilling SNARS 1.1 standards/elements. Judging from the time allocation, a model that can be completed in a short time was chosen. In terms of the allocation of funds, the researcher conducted interviews with the head of the hospital management information system and did not experience any obstacles due to the budget program related to module development at Dr. Ramelan Navy Hospital has been budgeted annually. a module development procedure has been proposed so that the E-Knowledge module development project can be started. In the development of the E-Knowledge module through several stages. Based on the previous description, the module development stages in the hospital management information system vary according to three aspects; human resource allocation, time allocation and financial allocation. The limited time allocation required the researcher and the team to decide to use a simple, effective and efficient model. The sprint development model is the right model to use in a short time. Supported by an adequate information technology infrastructure for the Dr.Ramelan Navy Hospital. The stages of the sprint model are map stage, sketch stage, decide stage, prototype stage and test stage.

Map stage is identify the long - term goals of the knowledge documentation module development. The aims of this stage are supports knowledge sharing between personnel to increase knowledge accurately because it comes from the same module source; improve personnel performance because it is faster to acquire knowledge and facilitate the

dissemination of knowledge to all personnel; to facilitate the needs of personnel in obtaining knowledge from various sources whose credibility is recognized nationally and internationally. To achieve this goal, the researcher conducted a questioner survey on the identification of the development of knowledge documentation modules on the hospital management information system. The module which was originally intended for training materials has developed into a module containing the latest regulations, references and journals. Regulations contain SOPs, Guidelines, References include information/users processes and procedures that apply in military hospitals as well as through discussions with the Nursing Committee and other Health Committees, resulted in tens names of PICs / persons in charge of filling out this module. The PIC consists of 3 nursing sub-committees and 7 professions from other health committees. The objectives of the establishment of this PIC are to monitoring the charging of the E-Knowledge module to run continuously, there are personnel who are responsible for documenting knowledge according to their respective professional fields, prevent misuse of important documents/accreditation standard documents by certain parties.

At the sketch stage the researcher makes an initial sketch of the module design based on literature studies and previous journals/research that have used the knowledge management system in hospitals.^{14,15} This chapter contains the design and design of the knowledge documentation module required by personnel in the form of a flowchart of knowledge documentation flowcharts carried out by the PICs and then personnel can access the knowledge content by logging into the hospital management information system¹⁶. The login mechanism has three access rights granted to the user, as a user, PIC and a team of experts. Access rights / use cases are determined based on needs. The role of the PIC in this module is very important because all access is given to be responsible for managing the E-Knowledge

module¹⁷. Users are given limited access to regulatory documents and can only view documents without being able to download regulatory documents. This is a form of anticipation to prevent duplication of regulations from outside parties and unwanted problems. The other three documents, namely references, training/seminar materials and journals can be viewed and downloaded for proper use. The expert team has access to manage configurations and manage users as well as overcome obstacles in the implementation of the E-Knowledge module.¹⁸

At decide stage, the design of the knowledge documentation module was decided upon which was agreed upon by all relevant parties. Then the results of the decision are presented to the PIC as the spearhead of the successful development of this knowledge documentation module^{19,20}. The objectives and targets for the development of the module were conveyed to the PICs at the inaugural meeting which was held on November 17, 2020. This module was well received by the PICs because this module in addition to facilitating as a forum for knowledge documentation as well as a method in various standards/elements of SNARS accreditation edition 1.1

At the prototype stage collaboration is carried out with the Information Technology (IT) team in making prototypes. The expert team played a major role in the success at this stage. The expert team for developing this module is a vendor / 3rd party who has collaborated on the development of Dr. Ramelan Navy Hospital. The allocation of time needed by the IT team in designing the prototype module is 10 days. It is planned to be completed and can be tested before December 4, 2020. Prototype testing is carried out at test stage. Before the trial day was carried out, the PIC was informed to prepare knowledge content to be included in the module when the pilot was carried out on December 2, 2020. This stage went smoothly and some content was successfully included in the module. After testing the prototype on several users, inputs were obtained for the improvement of the

features to be developed. The inputs for confidential accreditation documents, access rights are given only to the PIC according to their professional field and the PIC is responsible for its distribution. To upload documents in the form of articles/journals, the publication period is limited to a maximum of 5 years. Types of document formats that can be entered in PDF and image formats. Format documents and videos cannot be entered. Need further development content is included in folders and sub folders. At the implementation stage it has been implemented and will be re-evaluated.

CONCLUSION

Based on the results of the study, it can be concluded that E Knowledge increase knowledge and improve personnel performance. It acquires knowledge more quickly, and facilitates the dissemination of knowledge to all personel, as a means to facilitie personel needs in obtaining knowledge from credible various sources.

REFERENCES

1. Pudjirahardjo, W & Susanto, A. Intervensi Problem Solving Cycle (PSC) Berdasarkan 7 Prinsip Menuju Keselamatan Pasien Rumah Sakit Problem Solving Cycle (PSC) Intervention Program Based on 7 Principles to Hospital Patient Safety. 2019; 11: 76-9.
2. Amrin, M. Menetapkan Prioritas Masalah dengan Metode CARL, Agustus 10, 2018. Available From: <https://www.mitrakesmas.com/2018/08/menetapkan-prioritas-masalah-dengan.html>
3. Roohi, G., Mahmoodi, and Khoddam, H. Knowledge implementation in health care management: a qualitative study. *BMC Health Serv Res.* 2020; 20: 188. doi: [10.1186/s12913-020-5043-8](https://doi.org/10.1186/s12913-020-5043-8).
4. Ghosh, M and Sobek, D. A problem-solving routine for improving hospital operations. *Journal of health organization and management.* 2015; 29: 252-70. Doi: [10.1108/JHOM-09-2013-0191](https://doi.org/10.1108/JHOM-09-2013-0191).
5. Ayatulloh, D., Nursalam, N., Kurniawati, N. D., The Effect of Knowledge Management in Healthcare Services: a Systematic Review. *Jurnal Pendidikan Keperawatan Indonesia.* 2021; 7(1): 84-94.
6. Coccia, M. Fishbone diagram for technological analysis and foresight. *International Journal of Foresight and Innovation Policy.* 2020. 14: 225-47. doi: [10.1504/IJFIP](https://doi.org/10.1504/IJFIP).
7. Fadilla, NM, Setyonugroho, W, Sistem Informasi Manajemen Rumah Sakit Dalam Meningkatkan Efisiensi: Mini Literature Review *Jurnal Teknik Informatika dan Sistem Informasi.* 2021; 8(1): 357-74.
8. Shalannanda, W. and Hakimi, R. IT Governance design for Hospital Management Information System case study: X hospital. *The 10th International Conference on Telecommunication Systems Services and Applications (TSSA).* 2016: 1-8. Doi: [10.1109/TSSA.2016.7871108](https://doi.org/10.1109/TSSA.2016.7871108).
9. Anand, A., Singh, O., and Alhazmi, O. Optimal Sprint Length Determination for Agile-Based Software Development. *Computers, Materials & Continua.* 2021; 68: 3693-3712. doi: [10.32604/cmc.2021.017461](https://doi.org/10.32604/cmc.2021.017461)
10. Mahmood, N., Burney, S., Aqil, M., Abbas, Z., Rizwan, K. Data and Knowledge Management in Designing Healthcare Information Systems. *International Journal of Computer Applications.* 2013; 50: 34-9. doi: [10.5120/7745-0798](https://doi.org/10.5120/7745-0798).
11. Sutrisna, E. Implementasi Knowledge Management system berbasis website dengan model spiral pada PT Trans Retail Indonesia. *Jurnal Informatika Univeristas Pamulang.* 2018; 3(2): 64.
12. Perdana, T. R., Mujiatun, S., Sfenrianto, S., and Kaburuan, E. R. Designing Knowledge Management System with Big Data for Hospital Inpatient Services : (Case Study at Islamic Hospital XYZ Pekanbaru). *International Conference on Information and Communications Technology (ICOI ACT).* 2019: 851-56. doi: [10.1109/ICOI ACT46704.2019.8938469](https://doi.org/10.1109/ICOI ACT46704.2019.8938469).
13. Matayong, S., and Mahmood, A. K. The studies of Knowledge Management System in organization: A systematic review. *International Conference on Computer & Information Science (ICCIS).* 2012: 221-6. doi: [10.1109/ICCISci.2012.629724](https://doi.org/10.1109/ICCISci.2012.629724).
14. Alsaqqa, H. H. Knowledge Management and Sharing in Hospitals: A Systematic Review. *SG/NJ.* 2020: 25:27.



15. Meylasari U.P and Qamari I.N. Faktor-Faktor yang Mempengaruhi Knowledge Sharing dalam Implementasi E learning. Program Studi Manajemen Fakultas Ekonomi Universitas Muhammadiyah Yogyakarta. 2017; 8(2): 238 Available from: <https://media.neliti.com/media/publications/273159-faktor-faktor-yang-mempengaruhi-knowledge-c02c972.pdf>
16. Karna,N., Supriana, I., and Maulidevi,N. Implementation of e-Learning based on Knowledge Management System for Indonesian Academic Institution. The 1st International Conference on Information Technology, Information Systems and Electrical Engineering (ICITISEE). 2016: 43-48. doi: 10.1109/ICITISEE.2016.7803045.
17. Bowden, D.S., and Andrews, M. The Challenge of Knowledge Management in Healthcare. 13th Annual Conference of the EuroMed Academy of Business. 2020. Available from: <https://www.researchgate.net/publication/344475542>
18. Mohajan, H. An Analysis of Knowledge Management for the Development of Global Health. American Journal of Social Sciences. 2016; 4(4): 38-57.
19. Kurniawan,Y.,Johan and Sudiana. The Impact of Knowledge Management System in Hospital, International Conference on Information Management and Technology (ICIMTech). 2019: 641-5. doi: 10.1109/ICIMTech.2019.8843825.
20. Hujala T, Laihonen, H. Effects of knowledge management on the management of health and social care: a systematic literature review. Journal of Knowledge Management. 2021; 25(11): 203-21. <https://doi.org/10.1108/JKM-11-2020-0813>



Happy Smile of a New-Born Infant with Cleft Lip and Cleft Palate

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ABSTRACT

Background: Cleft palate of the new-born infants with or without cleft lip, are recognized to be at risk of feeding difficulties, making it difficult to maintain adequate nutrition, and also interfere the speech function and the parents also their psychological growth. **Purpose:** Surgical closure of the cleft lip may be accomplished shortly after birth to relieve the parents' anxiety as long as the general rules "triple tens" (more than : 10 week of age, 10 pounds of body weight, 10 grams of haemoglobine) that is frequently used in determining optimum timing for lip closure must be fulfilled. **Case Report:** Female baby at age 5 days, who was referred to pediatric dentistry clinic dr. Ramelan Naval Hospital Surabaya with parents complaining that their baby was born with cleft lip and palate and could not drink breast milk, easily choked, so they had to depend on the sonde. **Case management:** A maxillary feeding plate (=MFP) was made to close the cleft palate and regenerate the function of chewing and swallowing so that the infant obtains good nourishment and gain body weight until the palatal cleft closure operation. **Conclusion:** After the closure, her mother and family are psychologically able to prepare comprehensive protection for the child so that they too feel comfortable and confident. Smile can represent 80% of communication. When children feel comfortable because they can freely smile, this smile can attract other people to make it easier to adapt and socialize.

Keywords: Cleft Lip and Cleft Palate, Feeding Plate, Weight, Psychology.

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INTRODUCTION

Cleft Lip (CL) and Cleft Palate (CP) are disorder in the process of growth and development with the manifestation of a cleft in the lip or Palate and can be unilateral or bilateral. This gap not only affect the lips but also the Palate. This palate is a barrier between the nasal cavity and the mouth. CP can affect the hard palate or just soft palate or both. Disruption of the palate can cause interference with the process of mastication, swallowing and talking.^{1,2} CL is a disease caused by the contribution of environmental factors as well as genetic factors. The cause of most of these CL events is still unknown. 1 in 5 cases of CL are cases that occur due to genetic descendant. Risk factors for CL in infants have been around since the baby is still in the womb.^{1,2}

Some risk factors for the fetus to experience lip cracks are:^{2,3}

The mothers smokes, the mother has diabetes, consumption of certain drugs during pregnancy increase the likelihood of children experiencing CL, Rubella virus infection, deficiency of some vitamins during pregnancy. Pathogenesis The upper lip is a derivative of the medial nasal and maxillary processes. The failure to combine the medial nasal and maxillary processes in the fifth week of pregnancy, either on one or both sides, result in CL and usually occur at the junction between the central and lateral parts of the upper lip. Cleft can only affect the upper lip or can also extend further to the maxilla and primary palate. If palatal fail to occur also, CL occurs with CP, which forms Cleft Lip and Palate (CLP) abnormalities.⁴

Normally, secondary palate development starts from the right and left palatal processes. Palatal fusion begins at the 8th week of pregnancy and continue until the 12th week of pregnancy. CP occurs due to failure of total or partial fusion of the palatal. This can occur in several ways, like abnormalities in genes that regulate cell differentiation, growth, apoptosis, inter-cell adhesion, and cell signaling, as well as

interference with cell function due to teratogenic environment, or a combination of both.⁴

Environmental and genetic factors influence each other and play an important role in pathogenesis. Mothers who smoke during pregnancy are at risk of giving birth to children who experience CLP because the TGF gene mutation can occur. Smoking during pregnancy also affects embryonic growth by producing tissue hypoxia that interferes with tissue growth, especially the growth of the palate. In addition, serum folate can also decrease in pregnant women which can form a cleft or cleft that is often caused by folate deficiency.⁵

Alcohol consuming in pregnancy is often associated with abnormalities in the offspring called Fetal Alcohol Syndrome (FAS). This is because alcohol consumption by pregnant women can have teratogenic effects such as mental retardation, cardiovascular disorders, and sometimes clefting or crevices in the baby's oral cavity may occur.⁵

Some drugs can induce CLP. Chemotherapy drugs such as aminopterin, methotrexate, cyclophosphamide, procarbazine, and hydroxamic acid derivatives interfere with DNA synthesis that results in malformations in the fetus. The use of anti-seizure drugs, for example phenytoin, can inhibit overall embryonic growth, including facial prominences, which is characterized by a decreased rate of mesenchymal cell proliferation at facial prominences of around 50%.⁵ Formation of the baby's face occurs around seven to nine weeks after conception. Lips are formed around the seventh week and the roof of the mouth in the form of hard palate and soft palate, around nine weeks of age. Lips and palate grow individually, therefore it is possible to suffer either only CL or CP.^{5,6,7}

The clasification of CPL according to Veau can be categorized into :^{7,8}

- a. Classification 1 : only soft cleft palate or uvula
- b. Classification 2 : soft and hard cleft palate up to foramen incisivum



- c. Classification 3 : soft cleft palate, hard palate ---- involving alveolus and lip on one side
- d. Classification 4 : cleft on soft palate, hard palate ---- involving alveolus and lip on both sides

CLP of the new-born infants will cause trouble in lactation both from mother's milk and nursing bottle. This will cause limitation of mastication function and ease the entrance of foreign object to the nasopharynx. Infants are easily choked, therefore it is difficult in maintaining adequate nutrition and also disturb of the aesthetic and speech function.^{4,9}

Feeding cleft palate infants is different from that normal ones. For this special infants, to meet their nutritional needs, time, patience as well as the substitute for the lost palatal structure are badly required. Lack of knowledge on how to feed these infants frequently causes false ways by treating them as normal babies. Very often, the hole of the nipple of the nursing bottle is made larger to ease the lactation. This way of feeding, may bring about deglutition and aspiration of food, drink, saliva and air to the nasopharynx. Infection of the respiratory tract and even death may anytime happen.⁹

The difficulty in both eating and drinking will surely affect the infant's health. There have been found cleft palate babies with much less weight than the normal infants.^{8,10} "Maxillary Feeding Plate" (MFP) is a protesa made of acrylic, used to close the abnormal cleft between the oral and nasal cavities. The function of this is to help mastication, speech, maintenance of maxilla curve width and teeth arrangement, improvement of palatal growth, anti aspiration agent and in to gain normal palatal form to enable physiological position of the tongue.^{9,11}

In 1928 Wardill developed a new surgical technique. The palatal operation is commonly performed on 18 – 24 month babies. As for cleft lip, it can be done to babies of 3 months. The "Triple Ten" method is applied to babies above 10 weeks, Hb above 10 mgr/100 ml and body weight above 10 pounds. For

normal babies, it is not hard to reach, but for the cleft palate babies this may seem difficult.^{6,7,9,11} The results of research by Wardani, the difference in baby weight using Maxilla Feeding Plate (MFP) is very significant compared to those not using it. And babies without MFP do not get enough nutrition and make babies malnourished and this is stated in their lower body weight compared to those using MFP¹¹.

Patients with cleft lip and palate require extensive and routine care. Treatment is carried out in 4 stages, before the initial surgery to improve the shape of the lips, during the period of deciduous teeth, the period of mixed dentition, and the beginning of the period of permanent dentition.^{5,7} The goal is to get a better appearance, reduce the incidence of respiratory diseases, children can eat, talk, smile, listen and breathe as they should⁸.

CASE REPORT

A 5-days-old baby girl, who visited the clinic of pedodontics, Dental and Oral Depart., Dr Ramelan Naval Hospital Surabaya with her parents complaining that their baby was born with a cleft lip and palate and could not drink breast milk, was easily choked, so she had to depend on nasogastric tube. Patients are classified in group 4 (fig 1).



Fig 1. Patients are classified in group 4

CASE MANAGEMENT

Infants with bilateral CLP who visited the clinic of pedodontics, Dental and Oral Depart., Dr Ramelan Navy Hospital Surabaya. Name,

age, address, sex, parents' name, and body weight were recorded. Anamnesis and clinical examination to diagnose the cleft palate were performed. Extra and intra oral tests were also held.

Using special molding spoon (fig 2& 3) with "alginate fast setting", a palate shape was made. This palate shape was then casted using hard gypsum (fig 5). On the gypsum model, border line of the expected feeding palate was drawn (fig 6). The feeding plate was made of orthocryl, varnished and perforated with a small drill. This was done to tie the threat/dental floss to the middle front part of the feeding plate as additional fixation and safety (fig 7). The MFP was applied and checked on its position (fig 8).



Fig 2 & 3. Special tray



Fig 4. Tray is tried, then printed



Fig 5. Printout is casted using gypsum



Fig 6. The model is demarcated



Fig 7. MFP using orthocryl material



Fig 8. MFP is installed in patients



Fig 9. Patients can drink bottled milk and breast milk





Fig 10. monthly appointment during 1st, 2nd, 3rd 4th and month after MFP. The 5th operation was performed.



Fig 11. After CL operation

After the installation of the MFP, patients can drink breast milk or bottle milk (fig 9). In the first month, there was no significant difference in body weight compared to before using the MFP. However, the second month onwards shows that body weight continues to increase from month to month, so that the "Triple Ten" guidelines are met and the patient will undergo CL operation. In the 5th month the patient could have CL operation (fig 10 & 11).

DISCUSSION

Patients with CLP abnormalities usually cannot eat and speak properly. Surgery is the most important medical action to unite the cleft lip or sky in infants and children. With surgery, not only returns the anatomy to near normal, but also pays attention to the aesthetic aspects of the face, improves speech, eating and psychological functions of children and their families.¹² Generally parents of patients want the operation of the cleft lip to be carried out immediately, for aesthetic reasons.¹² Infants with this disorder the air entering the lungs is not filtered and warmed first by the nasal mucosa so that the baby will be susceptible to upper respiratory tract infections and easy to choke when drinking milk, so that it will cause respiratory problems that can be fatal if aspirated.^{3,4,9} Infants with CLP will have impaired swallowing function, making it difficult to meet their nutritional intake and consequently the child's nutritional value is reduced as shown in his body weight under the standard weight of the child^{6,7} According to Wardani's research, installation of MFP shows effectiveness in infants with CLP and is useful for helping the baby's development process through weight gain based on monthly observations where CLP infants who use MFP have higher average weight than average normal weight babies. same age.¹¹ Clinically, anatomically and physiologically, the organs involved in the ingestion function show that the palate, especially the palate soft plays an active role in the process of ingestion.

The child and family's psychics is the most important thing for the transition process of children back to school where mothers provide comprehensive protection so that children can smile confidently. As we get older, children are increasingly aware of their position as social creatures. The began to be sensitive to other people's views of him, and wanted to be well received in the midst of the environment. Body language including smiles can represent 80% of communication. When

children feel comfortable because they can freely smile, then this smile can attract other people to get close and hang out with him, making it easier for him to adapt and socialize.

CONCLUSION

Provision of MFP in newborn CL babies can help increase baby weight. As the baby's weight increases, his nutritional intake is fulfilled and the baby is immediately operated after meeting the Triple Ten requirements. Psychologically, mothers provide overall protection and support so that children can smile, trust relationships and be able to socialize especially in children with CLP abnormalities. Children will feel comfortable and free to smile, so they can attract other people to get close and associate with them, and make it easier for them to adapt and socialize, especially in children with CLP disorders. Children who have CLP abnormalities and have undergone surgery will have high hopes for their future.

REFERENCES

- Margulis AV, Mitchell AA, Gilboa SM, Werler MM, Glynn RJ, Hernandez-Diaz S, National Birth Defects Prevention Study. Use of Topiramate in Pregnancy and Risk of Oral Clefts. *American Journal of Obstetrics and Gynecology*. 2012; 207: 405.e1-e7.
- Facts about Cleft Lip and Cleft Palate | Birth Defects | NCBDDD | CDC [Internet]. Centers for Disease Control and Prevention. 2019 [cited 5 Agustus 2019]. Available from: <https://www.cdc.gov/ncbddd/birthdefects/cleftlip.html>
- Causes of Cleft Lip & Palate [Internet]. 2019 [cited 5 Agustus 2019]. Available from: <https://med.virginia.edu/pediatrics/about/clinicalandpatientservices/patient-tutorials/cleft-lip-palate/causes-of-cleft-lippalate/>
- Tolarova M. Pediatric Cleft Lip and Palate: Background, Pathophysiology, Etiology [Internet]. *Emedicine.medscape.com*. 2019 [cited 6 Agustus 2019]. Available from: <https://emedicine.medscape.com/article/995535-overview#a2>
- Prabhu S, Jose M, Krishnapillai R, Prabhu V. Etiopathogenesis of Orofacial Clefting Revisited. *Journal of Oral and Maxillofacial Pathology*. 2012; 16(2): 228
- Avery JK *Essential of Oral Histology and Embriology A Clinical Approach* St. Louis: C.V. Mosby; 1992 (pp 39-50).
- Converse, J.M.: Hogan, V.M dan Mc Carthy, J.G.: *Cleft Lip and Palato, introduction*, p.1930-1939 (dalam *Reconstructive plastic surgery*, vol.4. 2ed W. Company, Philadelphia, 1997, 1930-2500)
- Sjamsudin E, Maifara D. Epidemiology and Characteristics of Cleft Lip and Palate and the Influence of Consanguinity and Socioeconomic in West Java, Indonesia: A Five-Year Retrospective Study. *International Journal of Oral and Maxillofacial Surgery*. 2017 Mar 1; 46: 69.
- Stone C. Cleft Lip and Palate: Etiology, Epidemiology, Preventive and Intervention Strategies. *Anatomy & Physiology*. 2013; 04(3).
- Levaillant, Jean-Marc., dkk. Prenatal Diagnosis of Cleft Lip/Palate: The Surface Rendered Oro-Palatal (SROP) View of the Fetal Lips and Palate, A Tool to Improve Information-Sharing within the Orofacial Team and with the Parents. *Elsevier*. 2016. [cited 14 April 2018]. Available from: [di:www.jcmfs.com/article/S1010-5182\(16\)30015-4/fulltext](http://www.jcmfs.com/article/S1010-5182(16)30015-4/fulltext).
- Wardani, I, & Budipramana, E: FDI IDA Bali. The effect of Maxillary Feeding Plate as Palatal Cleft Closure in New Born Infants Can Increase Body Weigh. 2022.
- Berger, Z. E., & Dalton, L. J. Coping with a cleft II: Factors associated with psychosocial adjustment of adolescents with a cleft lip and palate and their parents. *The Cleft Palate-Craniofacial Journal*. 2011; 48; 82-90.



Surgical Excision of Fibrous Epulis in Generalized Periodontitis Stage III Grade C

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ABSTRACT

Background: Fibrous epulis was the most frequent non-plaque-induced gingival lesions categories from biopsied cases included hyperplastic lesions, malignancies and benign neoplasms. Because the lesion is nonspecific and histology is the foundation of a more precise diagnosis, dentists may have difficulty identifying fibrous epulis from other disorders. Furthermore, the recurrence rate is significant, thus long-term follow-up is required for fibrous epulis after therapy. **Purpose:** to report the therapy of fibrous epulis and the follow up after eight months. **Case:** A 30-year-old nonsmoker healthy man presented with a 3-month history of an enlarging mass on the anterior left mandible gingiva. A clinical diagnosis was fibrous epulis in generalized periodontitis stage III grade C. **Case Management:** After evaluation of initial therapy, complete excision with a surgical blade and curettage of the lesion were planned for the lesion therapy. Histopathology finding confirm the prior clinical diagnosis of fibrous epulis. Eight months following surgery, the gingiva around the region had a healthy and desirable shape with no signs of recurrence. The patient's surgical recovery was good. **Conclusion:** Within the limitations of this case study, complete excision and curettage of the fibrous epulis lesion are the preferred treatments because of its high recurrence rate. The histopathologic examination is crucial for determining the final diagnosis, and long-term follow-up is essential.

Keywords: Fibrous Epulis, Gingival Lesions, Periodontal Disease, Human and Health, Tumor

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INTRODUCTION

While plaque-induced gingivitis is one of the most common human inflammatory diseases, there are several non-plaque-induced gingival disorders that are less common but can have a significant impact on patients. Nonplaque gingival lesions are frequently indications of systemic diseases, although they can also be pathologic alterations restricted to gingival tissues.¹⁻³ Epulis is a word that is frequently used to describe non-plaque-caused gingival disorders that present as exophytic processes arising from the gingiva.^{1,2,4}

Fibrous epulis is part of true epulides, a form of inflammatory fibrous hyperplasia of the gingiva, also known as focal fibrous hyperplasia and also known as irritation fibroma. True epulides are classified into four types based on their histology: fibrous epulis, calcifying fibroblastic granuloma, pyogenic granuloma (vascular epulis), and peripheral/central giant cell granuloma. Fibrous epulis is commonly present as exophytic smooth-surfaced pink masses with a fibrous nature attached to the gingiva. The size ranges from tiny tumorlike processes with a diameter of a few centimeters to giant tumorlike processes with a diameter of several centimeters.^{1,2,5-7}

Fibrous epulis (35.47%) was the most frequent non plaque-induced gingival lesions categories from biopsied cases including hyperplastic lesions, malignancies, and benign neoplasms.⁸ Fibrous epulis is thought to affect 0.09 percent of the population. The majority of lesions affect the maxillary anterior interdental papilla, affect people of all ages, and affect women more frequently than males.^{4,9} The periosteum and periodontal ligament might be the sources of fibrous epulis.⁵ Local irritations, including poor-quality dental restorations, dental plaque, and calculus, contribute to its development.^{5,10-14} Although the reactive processes are assumed to indicate an excessive tissue response to restricted local irritation or damage, fibrous epulis generally presents with no symptoms.¹

Dentists are the primary healthcare providers for individuals with epulides lesions in terms of determining diagnosis and developing treatment regimens. Any such lesion should be familiar to them, and they should be able to diagnose, treat, or refer them for therapy.¹ However, because the lesion is nonspecific and histology is the foundation of a more precise diagnosis, dentists may have difficulty identifying fibrous epulis from other disorders. Furthermore, because the recurrence rate is significant, ranging from 7 to 45 percent, long-term follow-up is required for fibrous epulis after therapy.^{5,13,14}

The therapy of fibrous epulis in generalized periodontitis stage III grade C patients by conventional scalpel surgical excision was described in this article. The clinical and histological images of the gingival lesion, as well as the surgical techniques and supportive periodontal therapy, are all fully described. The recurrence rate was assessed after eight months.

CASE REPORT

A 30-year-old nonsmoker man presented with a 3-month history of an enlarging mass on the anterior left mandible gingiva. This is the first time this has happened to him. The patient claimed no systematic disease, and the gingiva growth had been asymptomatic except for the discomfort feeling. He was not under any medication and did not have any habits that might have predisposed him to the growth.

Extraoral examination revealed no abnormalities, and regional lymph nodes were normal as well. Intraoral examination revealed a painless gingival enlargement in relation to the lower-left canine and first premolar region, which was pedunculated, 10x10x4 mm in size, fibrous in appearance with a distinct erythematous border at the margins, and non-fluctuant swelling (Figure 1a). Bleeding on probing (BoP) and dental calculus supra and subgingival were found in that area as well by tactile examination. Gingival recession type 1 (RT 1) was assessed



on the labial site of first premolar. No tooth mobility in this region was noted. The radiographic examination did not demonstrate any bone involvement in the lesion area (Figure 1c). The initial diagnosis of the lesion was assessed as fibrous epulis with a differential diagnosis of pyogenic granuloma, peripheral giant cell granuloma, and calcifying fibroblastic granuloma.

In addition, intraoral examinations also revealed BoP on 70% of sites, with moderate oral hygiene status. 2-8 mm of clinical attachment loss (CAL) was observed on 42% of the teeth, with the worst bone loss in tooth 37. The radiographic examination confirms the bone loss and showed some furcation involvement lesion on both lower second molar. His periodontal condition was diagnosed as generalized periodontitis, stage III grade C according to the new periodontal disease classification.^{3,15}

CASE MANAGEMENT

The patient received oral health education as well as scaling and root planing during the initial phase of treatment. The intraoral result indicated that the inflammation had decreased after one week of management, but the mass

remained (Figure 1.B). Complete excision with a surgical blade and curettage of the lesion were planned for therapy. The patient was told about the therapy and given written consent, following local regulations. Local infiltration anesthesia by 2% mepivacaine (Scandonest 2 percent special, Septodont, France) was used on the buccal and lingual area, then the bleeding points were used to outline the epulis' edge with a half-moon dental explorer instrument. The tumor was removed with blade No. 15 angulated 45 degrees to the coronal plane using the conventional technique, which required the involvement of 1 mm of surrounding healthy tissue (Figure 2.A). The tumor was excised in one piece by removing its peduncle, and the excisional masses were preserved in a 10% neutral buffered formalin solution before being transported to the histopathology lab. The bone was carefully curetted once the base was evacuated (Figure 2.B). Mechanical pressure from a sterile cotton gauze is used to limit bleeding, and the final condition seen in figure 2c. Periodontal dressing (Coe pack, GC Asia) was then applied at the site for about one week (Figure 2.D).¹⁶ The patient was given the painkiller mefenamic acid 500 mg and told to come back in one week.

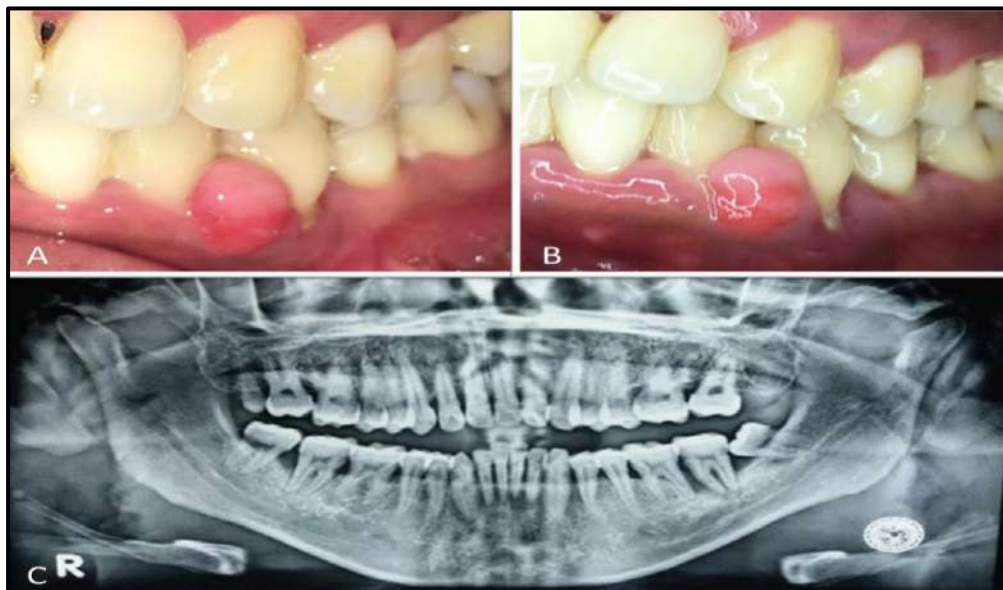


Figure 1. A. Clinical appearance at the first time. B. Clinical appearance after initial phase. C. Radiographic picture shows no bone loss around the mass.

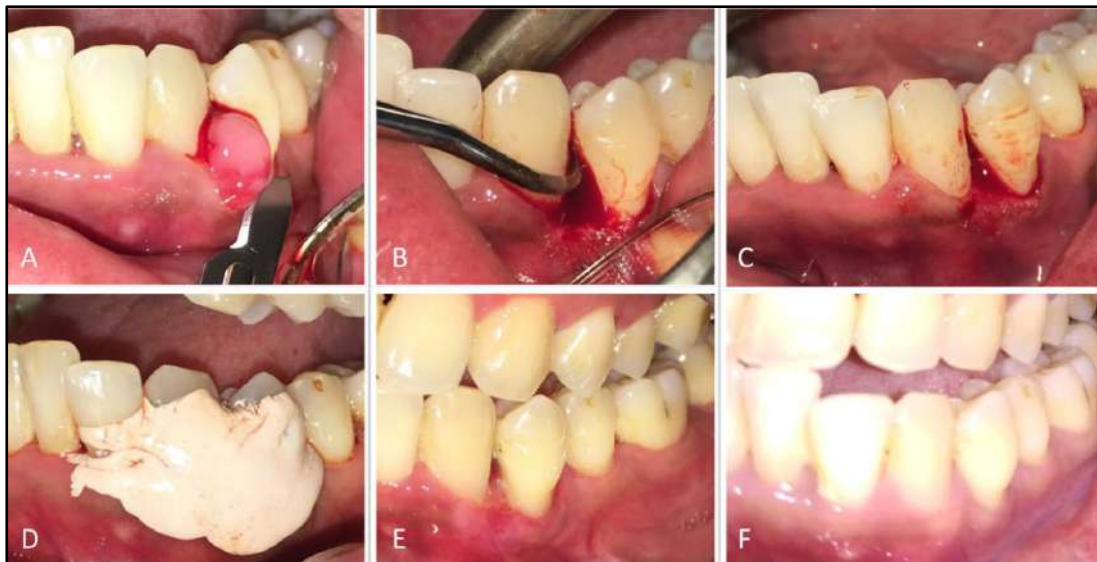


Figure 2. A. Excision by surgical scalpel blade, B. Debridement using curettage and subgingival calculus, C. Final condition after epulis excision, D. Periodontal dressing application, E. Clinical condition on first week control, F. Clinical condition on eight-month control.

The patient returned to the dental hospital a week later. He said that he had only taken the analgesic twice and had experienced no discomfort. After removing the periodontal dressing, the surgical region was irrigated with saline (Figure 2.E). According to an intraoral inspection, there was still some irritation near the gingival edge. Eight months following surgery, the gingiva around the region had a healthy and desirable shape (Figure 2.F) with no signs of recurrence. The patient's surgical recovery was good.

The histological microscopy result revealed hyperplastic squamous epithelium lining the tissue, with fibrous tissue including proliferative capillaries, some hemorrhages. Neutrophils, lymphocytes, histiocytes, and plasma cells infiltrate the stroma. There is no evidence of malignancy. Histopathology finding confirm the prior clinical diagnosis of fibrous epulis.

DISCUSSION

This patient was diagnosed with fibrous epulis in generalized periodontitis stage III grade C. Because of the high recurrence rate (7–45%),^{5,13,14} complete excision and curettage of the lesion is the optimum therapy, and long-term

follow-up is required. The gingiva around the location had a healthy and attractive form after one week and eight months evaluation after therapy, with no evidence of recurrence. The patient made a satisfactory recovery after surgery. The outcomes of this case's therapy are consistent with those of Ohta et al.,⁵ who followed up 20 months following full excision and curettage of the fibrous epulis and found no indication of recurrence. In contrast to our situation, they stated that the teeth affected had to be removed owing to severe underlying bone resorption. This result also consistent with the case reported by Fonseca et al.,¹¹ and Zhu et al.,¹⁴ who evaluated for over a year without lesion recurrence of the epulis after conventional removal surgical therapy.

Fibrous epulis is an exophytic pink mass with a fibrous nature that attaches to the gingiva. The size ranges from a pinhead to a tumor with a diameter of several centimeters. The attached gingiva was the most commonly impacted area (64.36%).¹ Low-level local irritation, traumatic damage, hormonal variables, or some drugs, according to some studies, may be the causes of this illness. Furthermore, because levels of female hormones such as estrogen and progesterone are unpredictable at this age, epulis in women can arise by the age of 20.^{1,5,14}

In the case of fibrous epulis, the most difficult thing for a dentist to do is to make a definitive diagnosis. Non-neoplastic and neoplastic lesions typically afflict the gingiva,⁷ with the latter characterized by gradual development that can be benign or malignant. The majority of localized gingival growths are reactive rather than malignant in character. The establishment of a clinical diagnosis, as well as an acceptable differential diagnosis, is a crucial milestone in case management.^{6,17,18} A histopathological investigation is essential for determining the definitive diagnosis. The histological findings, in this case, were similar to those reported by Zhu et al.,¹⁴ and Tajima et al.,¹⁹ who found that the fibrous epulis was composed of proliferating fibroblasts and collagen fibers with limited inflammatory cell infiltration and vascular dilatation. Collagenous fibromas, for example, might resemble fibrous epulis. On the other hand, collagen fibroma is an uncommon occurrence that is not accompanied by inflammatory symptoms. We disagree with Shimoyama et al.,²⁰ that lesion size may be utilized as a selection criterion in distinguishing between neoplasms and reactive lesions like epulis, is since fibrous epulis instances can range in size.

The treatment of an epulis is determined by its size and location, with excisional biopsy being the preferred technique in the majority of instances. However, dentists should be aware of two disadvantages of excisional biopsy. First and foremost, post-surgery recurrence should not be neglected. If the resection is not performed adequately, failure to eradicate local stimulating components and subsequent injury to the surgical site may result in epulis recurrence. Second, defects in soft tissue in the anterior area will cause cosmetic issues. The patient must be told of this respected finding throughout the informed consent procedure. Considering epulis tissue origin from the periosteum and periodontal ligament cells, fibrous epulis is generally treated with a thorough excision and extensive curettage of the affected area to prevent a reoccurrence. It is

usually not necessary to remove the next tooth unless there is significant underlying bone involvement. In our situation, bleeding was decreased by utilizing a surgical knife to execute a simple but controlled minimum peduncle excision and a modest dressing procedure. Controlled excision of the adjacent periodontal membrane, periosteum, and alveolar bone, as well as root planing to decrease irritation, are critical to avoid recurrence. We chose conservative surgical excision with gingival recontouring since there was no bone invasion and the severity of the treatment was more manageable. Whereas an electric scalpel or CO2 laser may perform bloodless surgery when the lesion is close to a vascular component, it may be a feasible option in instances where the lesion is thought to be close to a vascular component.

Nowadays, Pingyangmycin and propranolol intralesional injections were offered as new therapy options for fibrous epulis.¹² In our case, however, a typical surgical technique was combined with periodontal care to reduce the risk of recurrence and keep the therapy under control. For fibrous epulis removal, Zhu et al.,¹⁴ advocated minimally invasive periodontal surgery. The tumor tissues were removed and the epithelial and connective tissues of the tumor were retained in minimally invasive periodontal surgery. The retained tissues had a thickness of roughly 0.5 mm. The wound surface was then used to cover the reserved epithelial and connective tissues. When compared to traditional periodontal surgery, the study found that minimally invasive periodontal surgery improved the papilla filling index and the width of keratinized tissue. This approach might be utilized as a treatment option for certain epulis patients.¹⁴ In our case, the gingival recession severity was maintained following excisional therapy. After that, we proposed periodontal plastic surgery, but the patient's demands were not met.

According to Zhu et al.,¹⁴ the recurrence rate was also the same for traditional surgical resections and minimally invasive resections.

There were no incidences of recurrence for either treatment method after 0.5 to 2 years of assessment. The key aspects that contributed to the outcome was that all patients had had comprehensive non-surgical periodontal therapy before surgery to address local factors and oral hygiene instruction following surgery to ensure the patient's oral hygiene. The basic rule for preventing recurrence is full excision and curettage of the fibrous epulis lesion.^{5,10,11,13,14}

CONCLUSION

Within the limitations of this case study, complete excision and curettage of the fibrous epulis lesion are the preferred treatments because of its high recurrence rate. The histopathologic examination is crucial for determining the final diagnosis, and long-term follow-up is essential.

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REFERENCES

- Holmstrup P, Plemons J, Meyle J. Non-Plaque-Induced Gingival Diseases. *J Periodontol*. 2018; 89 Suppl 1: S28–45.
- Chapple ILC, Mealey BL, Van Dyke TE, et al. Periodontal Health And Gingival Diseases And Conditions on An Intact and A Reduced Periodontium: Consensus Report Of Workgroup 1 Of The 2017 World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions. *J Clin Periodontol*. 2018;45 Suppl 2:S68–77.
- Wijaksana IKE. *Perio Dx: Periodontal Sehat, Gingivitis & Periodontitis*. Surabaya: Airlangga University Press; 2020 (pp 46-59).
- Brierley DJ, Crane H, Hunter KD. Lumps and Bumps of the Gingiva: A Pathological Miscellany. *Head Neck Pathol*. 2019; 13(1): 103–13.
- Ohta K, Yoshimura H. Fibrous epulis: A Tumorlike Gingival Lesion. *Cleve Clin J Med*. 2021; 88(5): 265–6.
- Wijaksana IKE. *Perio Van: Q&A Anatomi, Struktur, & Fungsi Jaringan Periodontal*. Surabaya: Airlangga University Press; 2020 (pp 20-9).
- Ulfah N, Bargowo L, Paramita A, Wijaksana IKE, Setiawatie EM. Coronally Advanced Flap (CAF) for Treatment of Non-Carious Cervical Lesion Associated Single Gingival Recession. In: *Case Reports in Dentistry*. Nova Science Publishers, Inc.; 2018: 163–8.
- Hernández-Ríos P, Espinoza I, Salinas M, Rodríguez-Castro F, Baeza M, Hernández M. Distribution of Biopsied Non Plaque-Induced Gingival Lesions in A Chilean Population According to the Classification of Periodontal Diseases. *BMC Oral Health*. 2018; 18(1): 112-7.
- Shulman JD, Beach MM, Rivera-Hidalgo F. The Prevalence of Oral Mucosal Lesions in U.S. Adults: Data from the Third National Health and Nutrition Examination Survey, 1988-1994. *J Am Dent Assoc*. 2004; 135(9): 1279–86.
- Tamarit-Borrás M, Delgado-Molina E, Berini-Aytés L, Gay-Escoda C. Removal of Hyperplastic Lesions of the Oral Cavity. A Retrospective Study of 128 Cases. *Med Oral Patol Oral Cir Bucal*. 2005; 10(2): 151–62.
- Fonseca GM, Fonseca RM, Cantín M. Massive Fibrous Epulis-A Case Report of a 10-year-old lesion. *Int J Oral Sci*. 2014; 6(3): 182–4. <https://doi.org/10.1038/ijos.2013.75>
- Khzam N, Shah Mansouri R, Poli A, Bakr M. Fibrous Epulis Misdiagnosed for Combined Periodontic-Endodontic Lesion. *Int J Med Dent Sci*. 2017; 6(2): 1546–52.
- Laus M, Conti MA, Croce A. Giant Fibrous Epulis : A Case Report of a Benign Mass of the Oral Cavity. 2016;228–32.
- Zhu Y, Zhang H, Li C. The Clinical Application of Partial Removal Periodontal Surgery in the Therapy of Epulis. *Medicine (Baltimore)*. 2019; 98(27): 1-7.
- Papapanou PN, Sanz M, Buduneli N, et al. Periodontitis: Consensus Report of Workgroup 2 of the 2017 World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions. *J Periodontol*. 2018; 89 Suppl 1: S173–82.
- Ulfah N, Wijaksana IKE. Gummy Smile Treatment by Aesthetic Crown Lengthening on Altered Passive Eruption Case. *Acta Med Philipp*. 2021; 55(8): 860–4.



17. Agrawal AA. Gingival enlargements: Differential Diagnosis and Review of Literature. *World J Clin cases*. 2015; 3(9): 779–88.
18. Bargowo L, Wijaksana IKE, Hadyan FZ, Riawan W, Supandi SK, Prahasanti C. Vascular Endothelial Growth Factor and Bone Morphogenetic Protein Expression After Induced by Gurami Fish Scale Collagen in Bone Regeneration. *J Int Dent Med Res*. 2021; 14(1): 141–4.
19. Tajima H. A Histopathological and Immunohistochemical study of pathological ossification in epulis osteoplastica. *Oral Med Pathol*. 2009; 13(3): 91–8.
20. Shimoyama T, Horie N, Ide F. Collagenous Fibroma (Desmoplastic Fibroblastoma): A New Case Originating in the Palate. *Dentomaxillofac Radiol*. 2005; 34(2): 117–9.

The Challenges in Treating Uremic Stomatitis Patient with Chronic Renal Failure Disease

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ABSTRACT

Background: Uremic stomatitis is a rare oral manifestation of chronic and acute kidney disease. The incidence of uremic stomatitis is low, especially because process disease develops gradually over years and occurs in advanced renal failure. This disease is associated with high levels of blood urea. There are four forms of uremic stomatitis that have been identified, namely ulcerative, erythemopultaceous, hyperkeratotic and hemorrhagic. Usually the lesions were seen on buccal mucosa, dorsal or ventral surface of tongue, gingiva, lips and floor of mouth. **Purpose:** To discuss the challenges in treating uremic stomatitis patient with poor systemic condition. **Case:** A 73 year old male patient was referred from cardiology department to oral medicine department because there were painful lesions on lips, tongue, palate and buccal mucosa. He was a chronic kidney disease patient whose laboratory results showed high urea and creatinine values. **Case management:** The Patient was given oral hygiene instruction to clean his teeth and tongue with a gauze soaked in NaCl at least three times a day, compressing the lips and rinse with chlorine dioxide based mouthwash (Oxyfresh®, USA) three times a day. The improvement of oral lesions were not significant because the blood urea and creatinine value were still high. **Conclusion:** Management of uremic stomatitis needs multidisciplinary teamwork in order to achieve the kidney function and other comorbidities improvement as well as oral lesions to improve the quality of life.

Keywords: Chronic renal failure, Challenges, Uremic stomatitis

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INTRODUCTION

Uremic Stomatitis was first mentioned by Lancereaux in 1887 and later described by Barie in 1889 as an unusual complication of uremia. Uremia is the accumulation of waste product from nitrogenous waste product in the blood may be caused either chronic and acute kidney disease. Uremic stomatitis itself is a disease of the oral mucosa that is rarely found, this is mainly because hemodialysis therapy can help to repair kidney function so that along with the improving of kidney function, its manifestations are rarely found in the oral cavity.¹⁻³

Chronic kidney disease is a syndrome defined as persistent changes in kidney structure, function, or both and with implications for individual health. Examples of structural abnormalities include cysts, tumors, malformations and atrophy that are visible on imaging. Conversely, renal dysfunction can manifest as hypertension, edema, changes in urine output or quality and delayed growth in children, these changes can usually be recognized by elevated levels of serum creatinine, cystatin C or blood urea nitrogen (BUN).⁴⁻⁷

Chronic kidney disease that is not treated promptly will lead to chronic kidney failure. Chronic renal failure is a condition characterized by a gradual reduced function of homeostasis and renal filtration function. Clinically, chronic renal failure is known as uremia, a condition in which the kidneys fail to perform a very important function, causing retention of nitrogen, followed by an increasing urea in the blood, nitrogen and non-protein nitrogen. Chronic renal failure affects a number of tissues and systems and can cause complications in the nervous, cardiovascular, respiratory, endocrine, hematopoietic, gastrointestinal, urological system and craniofacial complexes.^{1,8}

Uremic stomatitis is often a clinical finding in the end-stage chronic kidney disease. Four main types of uremic stomatitis have been described, namely erythemopultaceous, ulcerative, hemorrhagic, and hyperkeratotic.

Histologically, uremic stomatitis is characterized by a mild infiltration of inflammatory cells in the connective tissue under the epithelium that is hyperplastic and abnormal keratinization.^{1,9,10}

In this article we report a case of ulcerative type uremic stomatitis in a patient with chronic kidney disease. The healing of uremic stomatitis lesions were not significant because of the kidney function was not improving.

CASE

A 73 year old male patient was referred to the oral medicine department Hasan Sadikin Hospital from the cardiology department. The patient complained of dry mouth followed by the appearance of a large number of ulcers in the oral cavity after one week of being hospitalized. The ulcers were very painful, making him difficult to chew and swallow food. The patient was treated with furosemide, clopidogrel, coamoxiclav, paracetamol, folic acid, lansoprazol, seretide, captopril and triamcinolone acetonide in orabase.

At first the patient admitted to the hospital, he complained that two weeks before his breath was short, the number of urination was decreased and two days before hospitalized he did not urinate at all. The diagnosed was acute kidney injury on chronic kidney disease (AKI on CKD) with a differential diagnosis of type 2 cardiorenal syndrome. His medical history including hypertension since 15 years ago, coronary artery bypass 7 years ago, and had been coronary stent placement 11 years ago. He did not suffer diabetes mellitus.

CASE MANAGEMENT

Extraoral examination showed that he was very sick and weak, anemic conjunctiva and non icteric sclera. On intraoral examination, there was a painful ulcerated lesion on the upper labial mucosa, shallow with yellowish-white base, firm edges, confluent, 2 cm in size. On the lower labial mucosa, the lesions were ulcerated, multiple, shallow with yellowish-white base,

irregular shape, firm edges and slightly elevated, 1 cm in size and painful. On the dorsal tongue, there were painful multiple ulcerated, superficial

lesions with yellowish-white base, indurated edges, 0.1-0.8 cm in size. (Fig. 1).

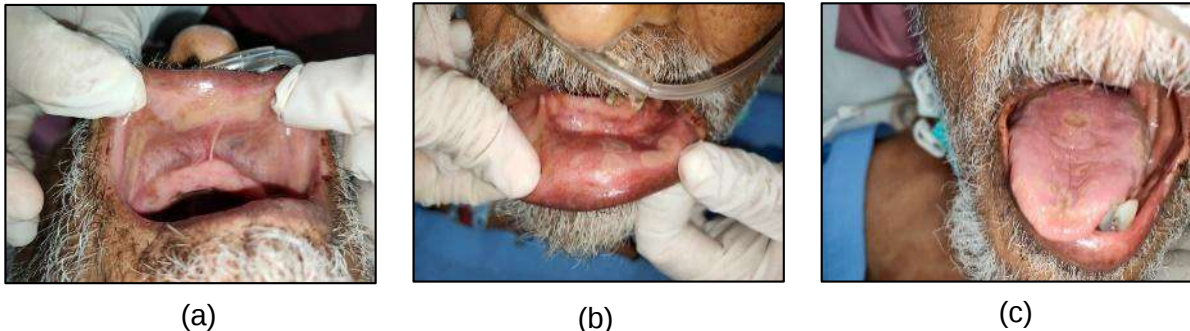


Figure 1. Ulcerated lesions on upper (a), lower labial mucosa (b) and dorsal of the tongue (c)

Laboratory results showed the value of urea was 142.7 mg / dl and creatinine was 3.12 mg/dl. The diagnosis of uremic stomatitis was made and the differential diagnosis was aphthous like ulcers. The patient was given oral hygiene instructions, including cleaning the oral cavity and tongue using gauze soaked in 0.9% NaCl at least 3 times a day. He was also instructed to compress the lips with gauzes soaked in chlorine dioxide (Oxyfresh®, USA) at least 3 times a day, rinsing with chlorine dioxide mouthwash 3 times a day, stopping

triamcinolone acetonide orabase as well as avoiding hard, dry and spicy foods.

After 2 weeks of therapy at our department, there was an improvement of the ulcerations on dorsum of the tongue, upper and lower labial mucosa (Figure 2). However, the improvement was not significant because at that time period, his urea and creatinine values had not returned to normal values (urea 107 mg / dl, creatinine 3.16 mg / dl). During hospitalization, he also underwent hemodialysis 2 times per week.

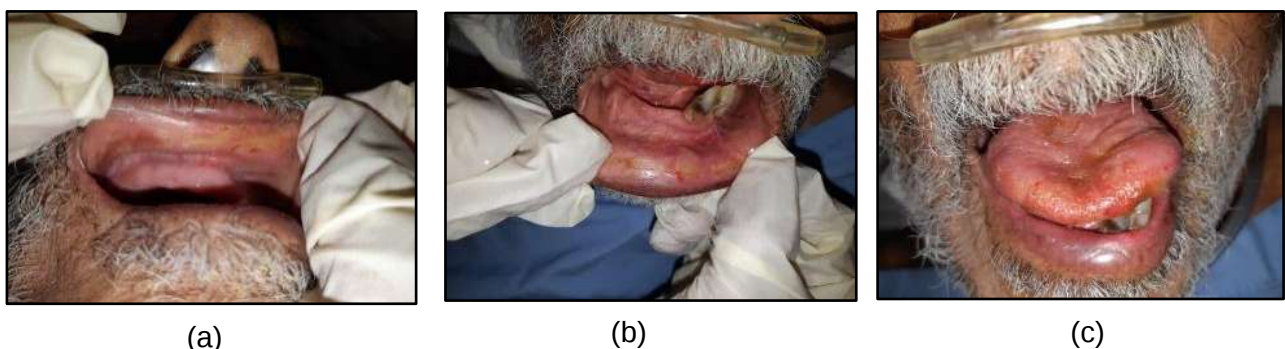


Figure 2. After 2 weeks, the lesions-at upper (a), lower labial mucosa (b) and dorsum of the tongue (b) were improved

DISCUSSION

Although the prevalence of oral conditions associated with high salivary urea levels in CKD patients is low, these disease can be observed in patients with high elevation of urea levels in blood. Apart from uremic stomatitis, other oral lesions in patients with

chronic renal failure including abnormal pigmentation of the lips, uremic halitosis, dysgeusia, xerostomia, gingival hemorrhage, periodontitis, candidiasis, burning sensation and ulceration. The patient in this case report also complained of xerostomia, which usually occurs in 28-59% of patients with end-stage renal disease that occurs due to polyuria, caused by

the inability of the kidneys to reabsorb sodium.¹⁰⁻¹²

Uremic stomatitis is an uncommon intraoral manifestation, it is usually seen in end-stage renal disease or chronic kidney disease that is undiagnosed or untreated. The etiopathogenesis of uremic stomatitis has not fully understood, however, it may be due to an increase in ammonia compounds. Ammonia is formed by the action of urease bacteria which converts urea in saliva which may affect the oral mucosa.^{13,14}

The patient in this case report suffered from acute kidney injury on chronic kidney disease (AKI on CKD) which from several epidemiological and experimental studies it was mentioned that AKI contributed to the progression and rate of deterioration of CKD. AKI in adults and children is strongly associated with an increased risk of developing CKD and the risk of incidence of CKD reflects the severity of AKI. AKI and CKD are interrelated syndromes, on one hand AKI contributes to the rate of deterioration of CKD, on the other hand CKD facilitates the patient's predisposition to the occurrence of AKI, and AKI on CKD has a poor prognosis. There are several changes in CKD, including changes the signalling pathways in epithelial cells, increases the induction of oxidative stress in the mitochondria, changes in the level of autophagy, changes in the inflammatory status of the kidneys and causing vascular dysfunction in blood vessels, All of these can increase the sensitivity or susceptibility of AKI and suppress renal repair in patients with AKI on CKD.¹⁵⁻¹⁷

The treatment of uremic stomatitis is to maintain the oral hygiene including plaque control and calculus removal to reduce the amount of urease and ammonia in the oral cavity. The patient in this case report was given instructions to clean his oral cavity with NaCl, The use of NaCl was to facilitate haemostasis and optimal healing by helping to maintain the wound area still moisture and removing or absorbing exudate, minimizing pain so that the comfort increased. The patient was also instructed to compress the lips with a mouthwash based on chlorine dioxide as well as gargling with the same medication. This mouthwash is a topical bactericide, its action is to reduce bacteria in the oral cavity by inhibiting ammonia production and preventing the ulcers

from secondary contamination, this is the goal of healing the lesions.^{10,18-20}

Complete healing of these lesions will only occur if the serum urea values return to normal. It was difficult to achieve in this patient although he had already undergone haemodialysis but the kidney function was difficult to improve, this was because he was suffering from AKI on CKD which lead the kidney function became difficult to work normally.

CONCLUSION

The healing of uremic stomatitis lesions is very dependent on the improvement of renal function, because if the urea value in the patient is still high, it will be difficult to achieve significant improvement of the lesions. Therefore, it is necessary to pay attention to the patient's systemic condition and carryout multidisciplinary treatment to heal the oral lesions and can help to improve the patient's quality of life.

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REFERENCES

1. Antoniadis DZ, Markopoulos AK, Andreadis D, Balaskas I, Patrikalou E, Grekas D. Ulcerative Uremic Stomatitis Associated with Untreated Chronic Renal Failure: Report of a Case and Review of The Literature. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology and Endodontology*. 2006; 101(5): 608–13.
2. Sudarshan R, Annigeri R, Mamatha G, Vijayabala Gs. Uremic stomatitis. *Contemp Clin Dent*. 2012; 3(1):113.
3. Talish M, DiLorenzo AM. Uremic Stomatitis. *New England Journal of Medicine*. 2020; 382(26): 2556.
4. Romagnani P, Remuzzi G, Glasscock R, Levin A, Jager KJ, Tonelli M, et al. Chronic Kidney Disease. *Nat Rev Dis Primers*. 2017;3.
5. Rangaswami J, Bhalla V, Blair JEA, Chang TI, Costa S, Lentine KL, et al. Cardiorenal Syndrome: Classification, Pathophysiology, Diagnosis, and Treatment Strategies: A Scientific Statement From the American Heart Association. *Circulation*. 2019 Apr 16; 139(16): E840–78.
6. Ronco C, Bellasi A, Di Lullo L. Cardiorenal Syndrome: An Overview. *Adv Chronic Kidney*



- Dis. 2018 Sep; 25(5): 382-390. doi: 10.1053/j.ackd.2018.08.004. PMID: 30309455.
7. O'Connor NR, Corcoran AM. End-Stage Renal Disease: Symptom Management and Advance Care Planning [Internet]. AAFP Lifestyle Medicine. Vol. 85. 2012. Available from: www.aafp.org/afp.
 8. Bachani L, L. A, Singh M, Kumar S, Tiwari T. Ulcerative Uremic Stomatitis: Canary in a Coalmine. Saudi Journal of Medicine. 2019; 04(09): 682–6.
 9. Liao CY, Wu CC, Chu PL. Uremic stomatitis. Qjm. 2017;110(4):247–8.
 10. Klein M, Munerato MC. Uremic Stomatitis in Three Patients and Review of The Literature. JSM Dent. 2016; 4(4):1–4.
 11. Oyetola EO, Owotade FJ, Agbelusi GA, Fatusi OA, Sanusi AA. Oral Findings In Chronic Kidney Disease: Implications for Management in Developing Countries. BMC Oral Health. 2015; 15(1):1–8.
 12. Dioguardi M, Caloro GA, Troiano G, Giannatempo G, Laino L, Petruzzi M, et al. Oral Manifestations in Chronic Uremia Patients. Ren Fail. 2016; 38(1):1–6.
 13. Mini M, Prasad TS, Thomas V. Uremic Stomatitis: Report of Two Cases. Oral and Maxillofacial Pathology Journal. 2015; 6(2):636–8.
 14. Yano H, Kinjo M. Uraemic Stomatitis. BMJ Case Rep. 2019; 12(10):1–2.
 15. He L, Wei Q, Liu J, Yi M, Liu Y, Liu H, et al. AKI on CKD : Heightened Injury, Suppressed Repair, and The Underlying Mechanisms. Kidney Int. 2017; 92(5):1071–83.
 16. Murugan R, Kellum JA. Acute kidney injury: what's the prognosis? Nat Rev Nephrol. 2011 Apr; 7(4): 209-17. doi: 10.1038/nrneph.2011.13. Epub 2011 Feb 22. PMID: 21343898; PMCID: PMC3547642.
 17. Farida LS, Thaha M, Susanti D. Characteristics of Patients with End-Stage Renal Disease at Dialysis Unit Dr. Soetomo General Hospital Surabaya. Biomolecular and Health Science Journal. 2018; 1(2): 97.
 18. Saini R. A Prospective Experimental Comparative Study On The Clinical and Antimicrobial Effects of Chlorine Dioxide Based Toothpaste and Mouthrinse in Periodontitis Patients- A One Year Follow-Up Study. International Journal of Biomedical and Advance Research. 2015; 6(605): 149–53.
 19. Arunkumar S, Annigeri RG, Shakunthala GK. Ulcerative Uremic Stomatitis - Review of The Literature and A Rare Case Report. Journal of Krishna Institute of Medical Sciences University. 2015; 4(1): 148–54.
 20. Huang BS, Wu SC, Lin CY, Fan KH, Chang JTC, Chen SC. The Effectiveness of A Saline Mouth Rinse Regimen and Education Programme on Radiation-Induced Oral Mucositis and Quality of Life In Oral Cavity Cancer Patients: A Randomised Controlled Trial. Eur J Cancer Care (Engl). 2018; 27(2): 1–10.



The Effect of Pineapple Peel Extract As a Denture Cleanser on Flexural Strength of Nylon Thermoplastic Denture Base Materials

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ABSTRACT

Background: Nylon thermoplastic has been widely used as denture base material because of its esthetic property, high flexibility, and flexural strength. It is very important to maintain the removable dentures' cleanliness, which is frequently done with the chemical technique by immersing the denture in a solution. The composition of malic acid and citric acid from pineapple peel extract has antibacterial and antifungal properties, so it can be used not only as a denture cleanser but also affect the flexural strength of denture base material.

Objective: To determine the effect of pineapple peel extract as a denture cleanser on the flexural strength of nylon thermoplastic denture base material. **Method:** This is experimental laboratory research with a post-test-only group design using 36 samples, namely 18 Valplast samples and 18 Lucitone FRS measuring 64mm X 10mm X 2.5mm divided into 4 groups (Valplast control, Valplast experiment, Lucitone FRS control, and Lucitone FRS experiment). The samples were treated by immersing them in sterile distilled water as control, and in 3.5% pineapple peel extract for 15 minutes 3 times a day for 10 days as treatment. Flexural strength measurement using Universal Testing Machine. The data obtained were analyzed by the One Way ANOVA test. **Result:** There was a decrease in flexural strength in the Valplast and Lucitone FRS groups immersed in 3.5% pineapple peel extract. Lucitone FRS groups had higher flexural strength than Valplast's. **Conclusion:** There is a decrease in flexural strength of nylon thermoplastic denture base after being immersed in 3.5% pineapple peel extract.

Keywords: Pineapple Peel Extract, Denture Cleanser, Flexural Strength, Nylon Thermoplastic

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INTRODUCTION

The material that is now widely used as denture base is nylon thermoplastic, because it has high flexibility and high mechanical strength so that it doesn't easily broke.¹ Nylon thermoplastic is a substance generated from a condensation reaction between diamine monomer and dibasic acid. Nylon contains a linear chain (single polymer bond) that has hexamethyldiamine and carboxylic acid which can form a long polyamide chain.²

Valplast dan Lucitone FRS are the two most produced brands of nylon thermoplastic denture base material in dentistry. Valplast is a polyamide resin which contains 99% polylaurylactam. This material has an elastic characteristic so that it does not easily broke, and it is also non allergic. The weakness of this material is its difficulty in finishing and polishing, which can be plaque retention sites.^{3,4} Denture cleansing with chemical technique, which can be done by immersing denture into a denture cleanser, can help reducing the plaque retention risk.⁵

Lucitone FRS is also a resin which made from polyamide microcrystalline. Lucitone FRS has harder physical property than Valplast and the other polyamide resin so that it has a better wear durability. The disadvantage of this material is that it absorbs much more water than Valplast material.³

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Flexural strength is one of the most important properties as consideration in comparing which one the better denture base material is, since the force on denture base is obtained from masticatory process. The flexural strength test can be done by placing a weight on the middle of the tested material with a crutch at its each corner. This test is called three-point bending, and the maximum stress counted in this experiment is called flexural strength.⁶

Pineapple peels contain malic acid and citric acid, which have very good antibacterial characteristic.⁷ The bromelain enzyme contained in the pineapple peel has also been proved capable to reduce and break the glutamine-alanine and arginine-alanine chain, so that it can reduce *Candida albicans* colony.⁸

The purpose of this research is to determine the flexural strength's difference between Valplast and Lucitone FRS after being immersed into 3,5% pineapple peels extract as denture cleanser, and focusing for the usage of pineapple peel extract, one of natural resources, to be an economic and environmental-friendly nylon thermoplastic's denture cleanser.

MATERIAL AND METHODS

This research is a true experimental laboratory with post-test only group design. The samples were divided into 4 groups, namely

Valplast control group, Lucitone control group, Valplast experiment group and Lucitone experiment group. There were 9 samples in each group, so the total was 36 samples.

The samples were formed as plate with 64 mm long, 10 mm wide, and 2,5 mm thickness, with the criterias: the surface must be smooth and flat, does not have any porous, and all samples have same size.⁹ The sampling technique in this research is total sampling.

A thousand grams of pineapple peels were prepared and dried, then extracted. The extraction method of the pineapple peels used in this research was maceration method, which goal is to dissolve all substances contained in the peels by using a solvent, which is 96% ethanol.¹⁰ After then, it was obtained 166 grams of viscous extract.

Each Valplast control group and Lucitone FRS control group samples were immersed into a sterile aquadest for 15 minutes, 3 times a day for 10 days. Each Valplast experiment group and Lucitone FRS experiment group samples were immersed into a 3,5% pineapple peel extract solution for 15 minutes 3 times a day for 10 days. Immersion process of each sample were carried out in a same size container.¹¹

Flexural strength testing of each sample was done with three-point bending method using a Universal Testing Machine. Each sample were placed on two corner with 44 mm distance, and set the cross head velocity to 5 mm/min. The power button was pressed to activate the machine, then pressed the Down button so that the flexural test machine can be done until the maximum weight the sample could resist. After the sample was broken, pressed the stop button and the maximum force obtained would be shown on the screen.¹²



Figure 1. Universal Testing Machine



Figure 2. Pineapple Peel

RESULTS

The research data obtained were analyzed using Shapiro Wilk normality test and Levene statistic homogeneity test. The normality test showed that the data has normal distribution ($p > 0,05$), so that it fulfills the requirement for parametric test. The homogeneity test of this research data showed $p < 0,05$, which showed that the data does not have a homogeneity variance.

The comparative test carried out in this research data is Oneway Anova because there are more than 2 unpaired groups with a normal data distribution but an inhomogeneous data variance. The data is said having a significant difference between the groups if the p value showed less than 0,05 ($p < 0,05$). The comparative test of this research data showed $p < 0,05$ so that can be interpreted that there is a significant difference between the flexural strength test groups data (MPa) (table 1).

Table 1. One Way ANOVA Test Result

	Result Mean Square	F	Sig.
Between Groups	25.929	110.463	.000
Within Groups	.235		
Total			

The ANOVA test showed there were a significant difference ($p < 0,05$) between the flexural strength test groups.¹³ Based on the LSD test result ($p < 0,05$), it can be stated that there was a significant difference between:

- Valplast Control Group and Lucitone FRS Control Group.

- Lucitone FRS Control Group and Valplast Experiment Group.
- Valplast Experiment Group and Lucitone FRS Experiment Group.
- Lucitone FRS Experiment Group and Valplast Control Group.

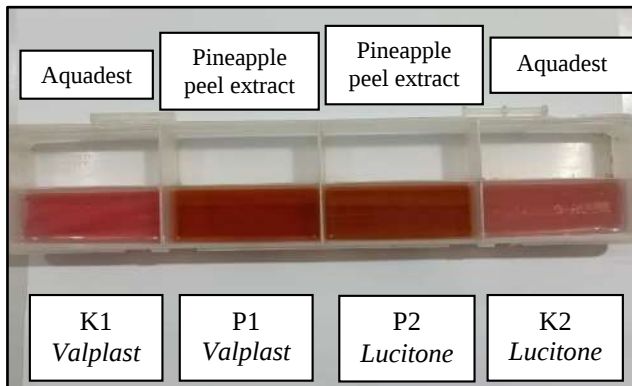


Figure 3. Nylon thermoplastic *Valplast* and *Lucitone FRS* were immersed in aquadest as a control and in 3,5% pineapple peel extract as a treatment.

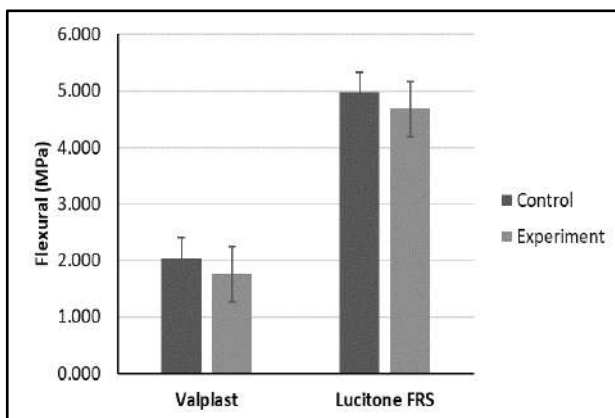


Figure 4. The bar chart shows result of Flexural Strength Test (MPa) between each group.

The laboratory test of this research showed that there was a slight decrease in flexural strength of each samples after being treated by immersing them into the 3,5% pineapple peel extract. The flexural strength mean value of Valplast group before given treated was 2.040 Mpa, after given treated became 1.763 Mpa, and the flexural strength mean value of Lucitone group before given treated was 4.972 Mpa, after given treated became 4.684 Mpa (figure 4).

DISCUSSION

Flexural strength is an ability of a restoration material to resist the force in masticatory process, which is a combination of compressive strength and tensile strength.¹⁴ Flexural strength is considered as an indicator of material's mechanical properties. Flexural strength testing is carried out with three-point bending method using a Universal Testing Machine.⁶

The purpose of this research is to find out the difference of Valplast and Lucitone FRS nylon thermoplastic's flexural strength after being immersed into 3,5% pineapple peel extract as a denture cleanser.

Nylon thermoplastic is now an alternative as denture base material which was made from a polyamide resin.¹⁵ Polyamide is generated from a condensation reaction between diamine (2-NH₂ group) and dibasic acid or carboxylate acid (2-COOH group). This material has a good flexibility characteristic, it is light weight and is not easily broken, it can be retentive on its position while resisting the masticatory load so that the material provides comfort as a denture.¹⁶

Nylon thermoplastic is a crystalline polymer. This crystalline property makes the nylon thermoplastic has a long chain which causes this material is not easily dissolved in a solvent, so that it is able to resist from abrasion, chemical solution, and highly stable.¹⁷

Lucitone nylon thermoplastic has a higher flexural strength mean value than the Valplast one, either in the control group or the experiment group. This result shows that the Lucitone nylon thermoplastic has lower flexibility than Valplast. This result is in accordance with the study done by Vojdani & Giti (2015) which suggested to use valplast for a tooth abutment that has bigger undercut because valplast material has higher flexibility so that it can pass through the undercut area.¹⁷

There is also a higher decrease of the flexural strength value on the Lucitone experiment group than the Valplast experiment group. This result is again in accordance with the

study by Kenji *et al* (2014) which stated that Lucitone has higher water-absorbing ability, it can absorb 28-30 $\mu\text{g}/\text{mm}^3$ water, compared to Valplast which can absorb water for 17 $\mu\text{g}/\text{mm}^3$.³ Lucitone also has higher hydrophilic properties so that the water molecule will be more easily absorbed by this material. This water-absorbing ability is obtained from the molecule chain of amide group. The higher the concentration of amide group, the more water can be absorbed.¹⁸

Pineapple peel was chosen for this research's sample to reduce the waste pollution, since the peel contains malic acid, citric acid, and bromelain enzyme.⁷ These two organic acids have a very good antibacterial property, which have a very low pH (about 3,71), and the bromelain enzyme have antifungal property, so that the pineapple peel extract has a good potency to be used as a denture cleanser.^{19,20} Research by Dayasoeharso (2016) and Posuma (2016) concluded that pineapple peel extract within 3,5% concentration was very effective as a denture cleanser in detaining the growth of *Candida albicans*.^{21,22}

The experiment group on both Valplast and Lucitone, which was given treated by immersing into the 3,5% pineapple peels extract (figure 3), show decrease in their flexural strength than the control groups'. The flexural strength's decrease can be caused by the citric acid composition which can cause oxidation process and absorbs water into the polyamide resin so that the malic acid and citric acid release hydrogen (H^+) ions and bond the polyamide chain. The polymer chain in the thermoplastic nylon can be dissolved by the solvent molecule which will weaken the chemical structure followed by the decrease of the polymer's strength properties.^{1,23}

The One Way ANOVA result showed the significance value was lower than 0,05 ($p < 0,05$) which can be stated that there is a significant difference between the group's data. The difference in flexural strength average in each group then is described in the LSD result, which showed that there is a significant difference between the control group and the experiment

group, both in valplast and lucitone, which showed flexural strength decrease in the experiment group. This research result is in accordance with the result of research done by Sundari *et al* (2016) which stated that the flexural strength decrease of the nylon thermoplastic was caused by the water absorption.¹ Water plays a role in hydrolytic degradation and erosion by stretching the matrix's fillers.²⁴ The water absorption by a diffusion process into the polymer will cause the solvent molecules penetrate and took place between the chain, so that the chain will be stretched then degraded. This degradation and water molecules between the chain then cause two impacts, the first is expansion of the polymer mass, or the second is the strength decrease of the polymer, especially the flexural strength. The longer is the immersion time, the more solvent molecule penetrates the intermolecular space so that the polar interaction will decrease and affects the flexural strength.^{1,12}

CONCLUSION

Based on the research result, it can be concluded that there is a decrease of the flexural strength of Valplast denture base and Lucitone denture base after being immersed into 3,5% pineapple peel extract.

REFERENCES

1. Sundari I, Sofya PA, Hanifa M. Studi Kekuatan Fleksural Antara Resin Akrilik Heat Cured dan Termoplastik Nilon Setelah Direndam dalam Minuman Kopi Uleekareng (*Coffea robusta*). Journal of Syiah Kuala Dentistry Society. 2016; 1(1): 51–8.
2. Laxman SK, Dayakarya HR, Richa S. Flexible Denture for Partially Edentulous Arches - A Case Report. Journal of Dentofacial Science. 2012; 1(2): 39-42.
3. Kenji F, Ohkubo C, Yatabe M, Arakawa I, Arita M, Ino S. Clinical Application of Removable Partial Denture Using Thermoplastic Resin. Part II: Material Properties and Clinical Features Of Non-Metal Clasp Dentures. Journal Of Prosthodontics Research. 2014; 58: 71-84.
4. Rizani MU. Perbedaan Kekuatan Ikatan Geser



- antara Anasir Gigi Tiruan Anterior dengan Berbagai Bahan Basis Gigi Tiruan Nilon Termoplastik [skripsi]. Medan: Fakultas Kedokteran Gigi Universitas Sumatera Utara; 2018 (pp 9-24).
5. Gajwani-Jain S, Magdum D, Karagir A, Pharane P. Denture Cleanser : A Review. IOSR Journal of Dental and Medical Sciences (IOSR-JDMS),. 2015; ver.IV Feb 14(2): 94-6.
 6. Sakaguchi R, Ferracane J, Powers J. Craig's Restorative Dental Materials 14th ed. St. Louis: The Mosby; 2019 (pp 514-49).
 7. Loon YK, Satari MH, Dewi W. Antibacterial Effect of Pineapple (*Ananas comosus*) Extract Towards *Staphylococcus aureus*. Padjajaran Journal of Dentistry, 2018; 30(1): 1-6.
 8. Anggraini D, Rahmides WS, Malik M. Formulasi Sabun Cair dari Ekstrak Batang Nanas (*Ananas comosus*) untuk Mengatasi Jamur *Candida albicans*. Jurnal Penelitian Farmasi Indonesia. 2012; 1(1): 30-3.
 9. Singh R, Chawla PS, Shaw E, Rajanikanth AV, Mehrotra A, Pandey V. Comparison of Flexural Strength and Surface Roughness of Two Different Flexible and Heat Cured Denture Base Material: An in vitro Study. The Journal of Contemporary Dental Practice. 2018; 19(10): 1214-20.
 10. Mulyanti D, Rismawati E, Maulana I. Uji Aktivitas Antibakteri Ekstrak Etanol Daun Sirsak (*Annona muricata* L.) Pada Bakteri *Propionibacterium acnes*, *Staphylococcus aureus*, dan *Staphylococcus epidermis*. Prosiding SNaPP 2015 Kesehatan. 2015; 1(1): 325-30.
 11. Porwal A, Khandelwat M, Punia V, Sharma V. Effect of Denture Cleansers On Color Stability, Surface Roughness, and Hardness of Different Denture Base Resins. The Journal of Indian Prosthodontic Society. 17(1): 1-7.
 12. Amalia A, Mozartha M, Trisnawaty. Pengaruh Lama Pemaparan Cuka Pempek Terhadap Kekuatan Fleksural Basis Gigi Tiruan Nilon Termoplastik. Banda Aceh: Proceeding Aceh Syiah Kuala – Dental Meeting III (Asyiah-DM III) PSKG FK UNSYIAH. 2013: 98-103.
 13. Dahlan MS. Statistik untuk Kedokteran dan Kesehatan, Deskriptif, Bivariat, dan Multivariat, Dilengkapi Aplikasi Menggunakan SPSS, Edisi 6. Jakarta: Epidemiologi Indonesia; 2014 (pp 13-14, 225-30).
 14. Anusavice KJ, Shen C, Rawls HE. Philips Sciences of Dental Materials 2th ed. St. Louis: Mosby Elsevier; 2013 (pp 476-96).
 15. Kohli S, Bahtia S. Flexural Properties of Poliamida Versus Injection-Molded Polymethyl-methacrylate Denture Base Materials. European Journal Of Prosthodontics. Sep-Dec 2013; 1(3): 56-60.
 16. Thakral GK, Aeran H, Yadav B, Thakral R. Flexible Partial Dentures – A Hope For the Challenged Mouth. People's Journal Of Scientific Research. 2012; 5(2): 55-9.
 17. Vojdani M, Giti R. Polyamide as a Denture Base Material: A Literature Review. Journal of Dentistry Shiraz University of Medical Sciences. 2015; 16(1): 1-9.
 18. Warinussy RPL, Kristiana D, Soesetijo FXA. Pengaruh Perendaman Nilon Termoplastik dalam Berbagai Konsentrasi Ekstrak Bunga Cengkeh Terhadap Modulus Elastisitas. E-Jurnal Pustaka Kesehatan. 2018; 6(1):179–85.
 19. Eliuz EAE. Antimicrobial Activity of Citric Acid Against *Escherichia coli*, *Staphylococcus aureus* and *Candida albicans* As A Sanitizer Agent. Eurasian Journal of Forest Science. 2020; 8(3): 295-301.
 20. Susanti D. Kajian Pemanfaatan Enzim Bromelain dari Limbah Kulit Nanas (*Ananas comosus*) untuk Melunakkan Daging [skripsi]. Medan : Fakultas Matematika dan Ilmu Pengetahuan Alam Universitas Negeri Medan; 2012 (pp. 14-5).
 21. Dayasoeharso AA. Pengaruh Effervescent Ekstrak Kulit Nanas dalam Menghambat Pertumbuhan *Candida albicans* Pada Resin Akrilik Heat Cured [skripsi]. Surabaya: Fakultas Kedokteran Gigi Universitas Hang Tuah Surabaya; 2016 (pp 45).
 22. Posuma TA. Efektifitas Sabun Cair Ekstrak Kulit Nanas Sebagai Pembersih Basis Gigi Tiruan Resin Akrilik Heat Cured Terhadap Pertumbuhan *Candida albicans* [skripsi]. Surabaya: Fakultas Kedokteran Gigi Universitas Hang Tuah Surabaya; 2016 (pp 6).
 23. Hafid IR, Sudibyo, Harniati ED. Kekuatan Transversa Termoplastik Nilon Pasca Perendaman. Seminar Nasional Mahasiswa Unimus. 2018; 1(1): 12-9.
 24. Van Noort R. Introduction to Dental Material 4th Ed. London: Mosby Elsevier; 2013 (pp 175-78).

