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RESEARCH ARTICLE

Black Tea Jelly Candy (*Camellia Sinensis*) to Increase Salivary Volume in Elderly: Preliminary Research

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ABSTRACT

Background: *Physiological changes in the elderly include decreased saliva production that causes dry mouth, difficulty in chewing and swallowing. Chewing gum and candies with a chewy texture like jelly can help stimulate the salivary glands. Black tea contains some phenolic and flavonoid compounds that have antioxidant properties that can increase the saliva flow rate.* ***Objective:*** *To determine the gap in saliva volume of elderly subjects before and after chewing black tea jelly candy compared to the saliva production when subjects chewed non-black tea candies and the control group (no treatment). This study also determined the prevalence of xerostomia in subjects.* ***Materials and Methods:*** *This field experiment was conducted using a Randomized Controlled Clinical Trials design with a pretest-posttest control group design. 30 elderly subjects aged 45-90 years in the Tresna Werda Budi Mulia 1 Nursing home, Jakarta were selected based on the predetermined inclusion criteria. They signed the informed consent and answered the Summated Xerostomia Inventory Questionnaire (SXI). Salivary volume before and after chewing black tea jelly candy was measured using a measuring cup. Statistical tests consisting of Oneway ANOVA and Dependent T-Test were performed to analyze the data.* ***Results:*** *The prevalence of elderly who complaining of xerostomia in this research was 40%. There was a significant gap in saliva volume between the three groups with p = 0.002 (P<0.05). An increase in saliva volume in the black tea jelly candy treatment group was identified. The average volume before intervention in the black tea jelly candy treatment group was 1.26 mL and after the intervention was 2.15 mL.* ***Conclusion:*** *Chewing black tea jelly candy increase the saliva volume in elderly subjects.*

Keywords: *Black Tea, Dry Mouth, Eelderly, Jelly Candy, Saliva*

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INTRODUCTION

Dry mouth (Xerostomia) often occurs in the elderly due to a decrease in salivary flow (hyposalivation). This physiological problem is caused by the decrease in the number of acinar cells, causing lower saliva production[1]. Saliva contains 99.5% water and other substances consisting of Calcium, Phosphorus, Sodium, and Magnesium. Saliva functions as a lubricant, protector, buffer, cleanser, and anti-bacterial. Low saliva production reduces the protection of the teeth, leading to negative consequences including reduced antibacterial function, inadequate food residue cleansing and reduced buffering due to changes in oral acidity makes the oral environment more acidic. Saliva flow in the mouth is closely related to the pH of saliva which shows the degree of acidity or alkalinity of body fluids. The ideal pH level in saliva is 6.7 (alkaline). Several factors cause changes in salivary pH including the saliva flow rate, oral microorganisms, and the buffering capacity of saliva. The salivary flow rate can be stimulated by mechanical and chemical means. Salivary flow rate can be mechanically increased through masticatory activity and chemically increased by sour, sweet, salty, and bitter tastes that stimulate the salivation reflex[2].

Lozenges can stimulate salivary flow that can treat dry mouth.[3] Chewing sugar-free candy or sucking on hard candies also helps stimulate salivary flow.[4] Research on the effect of different types of candy in treating dry mouth (Xerostomia) has been widely carried out. A research has shown the effect of chewing gum in increasing the salivary flow rate.[5] Other research also showed the ability of black tea in increasing the salivary flow rate.[6,7,8] Black tea produced from the Camellia plant offers positive benefits for health. Black tea contains phenols and flavonoids that give many benefits, including as antioxidants. Black tea is fermented tea favored by many people for its distinctive taste that it is widely used in food products, including black tea jelly candy.

The simplified Xerostomia Inventory (XI) questionnaire called the Summated Xerostomia Inventory (SXI) containing five questions was employed to identify and measure the symptoms and severity of xerostomia[9,10]. The questionnaire was translated into Indonesian language and tested for validity and reliability. [11] Research on xerostomia symptoms in the elderly in Indonesia, particularly those that employed SXI are still limited. This research was carried out to determine the volume of saliva in the elderly subjects before and after consuming black tea jelly candy compared to the control group and non-black tea jelly candy treatment to analyze subject's complaints or self-perception of xerostomia.

MATERIALS AND METHODS

This field-experimental research examined the effects of different treatments on research subjects. The Randomized Controlled Clinical Trials with a pretest-posttest control group design was used.

This research took place in Tresna Werda Budi Mulia 1 Nursing Home, Jakarta in March 2022. Elderly aged 45-90 years were the population of this research, from which 30 samples were selected. This research is preliminary research done to obtain initial data regarding the effect of black tea candy in increasing saliva volume. Since this research was carried out during the COVID-19 pandemic, the researchers were restricted to including more samples and had to strictly apply safe saliva draw technique.

The inclusion criteria included the people aged 45 - 90 years, did not use drugs and therapies that affect saliva, did not suffer from diabetes, rheumatoid arthritis (RA), HIV, or Sjogren's syndrome, and were willing to sign a letter of consent as research subjects. Meanwhile, the exclusion criteria included subjects who did not consent and were not cooperative during the sampling. A simple random sampling technique was performed to

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select 30 samples. The independent variables of this study were the SXI score and treatments with 0.2% black tea jelly candy, jelly candy without black tea, and control without treatment, while the dependent variable was saliva volume. This research has received ethical approval from the ethics committee of YARSI University with registration number: 017/KEP-UY/BIA/I/2022.

The ingredients of black tea jelly candy were black tea, water, sucrose, distilled water, tamarind salt, and beef gelatin. These ingredients are mixed, then heated and then left at room temperature so that candy with the consistency of jelly will be formed. The procedure for collecting saliva at the baseline for the control group was to collect unstimulated saliva in a measuring tube. After 5 minutes, subjects gargled in distilled water before their saliva was collected again. As for the black tea treatment group, before consuming the jelly candy without tea or in the black tea jelly candy, subjects were instructed to slightly bow their heads during saliva collection. Saliva collection was carried out for 5 minutes with the interval of spitting into the saliva container once every 1 minute. The saliva volume in the containers was measured. Then the treatment group was instructed to chew jelly candy for approximately 5 minutes. During the saliva collection in the post-intervention examination after consuming black tea and non-black tea jelly candies, subjects were instructed to slightly bow their heads slightly. Saliva collection was carried out for 5 minutes with the interval of spitting into the saliva container once every 1 minute. The volume of saliva in the container was measured according to the number printed on the container.

Every subject was required to answer the SXI questionnaire which consisted of 5 questions that had been validated to determine the prevalence of xerostomia. Each question is answered in a 3-point Likert scale expressing never = 1; sometimes = 2; and often = 3. All the answers were summarized with a total score ranging between 5-15. The total score was then categorized into categories of normal or no xerostomia complaints (5-7); mild (8-10); moderate (11-13); and severe complaints (greater than 13).[11] The data were then statistically analyzed in Shapiro Wilk normality test, dependent T-Test, Wilcoxon and Oneway ANOVA using SPSS program.

RESULTS

The frequency distribution based on the different groups, number of subjects, sex, age, and saliva volume is presented in the following tables.

Table 1. Frequency distribution based on different treatments and subject's sex

Variable	Group						Total	
	Control		Non-black tea		Black tea			
	N	%	N	%	N	%	N	%
Number of Subjects	10	100	10	100	10	100	30	100
Sex:								
- Male	4	40	4	40	3	30	11	36.7
- Female	6	60	6	60	7	70	19	63.3

The table above shows that each group consists of 10 elderly subject (100%). There were more elderly women (63.3%) than elderly men (36.7%).

Table 2. Subject's complaints of xerostomia based on the SXI

Degree of Severity	Number of Subjects	p value
Normal	18	60%
Mild	5	16.7%
Moderate	3	10%
Severe	4	13.3%
Total	30	100%

Table 2 presents the complaints of xerostomia of 40%, while the 60% of the

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subjects did not complain about having xerostomia.

Table 3. The results of *Wilcoxon* test before and after treatment in the control group

Group	Saliva Volume		*P-value*
	Before	After	
	Median (Min-Max)	Median (Min-Max)	
Control	0.40 (0.1-1.0)	0.21(0.1-0.5)	0.114
Black tea jelly	1.00 (0.2-4.0)	2.15 (0.5-4.0)	0.018*
Non-black tea jelly	1.55 (0.5-3.0)	1.90 (1.0-4.0)	0.059

Table 3 presents the saliva volume before and after the intervention. The control group shows no significant difference with p value of 0.114 (p>0.05). Meanwhile, the one of non-black tea shows no significant difference with p value of 0.059 (p=0.05). In the black-tea treatment group, a significant difference was found in saliva production with p value of 0.018 (p < 0.05).

Table 4. The results of Oneway ANOVA and Posthoc tests among the three groups

Group	ΔSaliva Volume		Post Hoc		
	Mean ± SD	p-value		Jelly	Jelly + Tea
Control	-0,19± 0.32	0.002	Control	0,015	0,001
Jelly	0.35± 0.47		Jelly	-	0.165
Jelly + tea	0.89± 0.89		Jelly + tea	-	-

In the Table 3, gaps in saliva volume (salivary volume after treatment minus saliva volume at baseline) among the three groups indicate a significant difference with a value of P=0.002 (P<0.05). The results of the post hoc follow-up test also show a significant gap between the control group compared to the jelly candy group without tea, namely P = 0.015 (P < 0.05) and the control group with black-tea jelly candy with p = 0.001 (P < 0.05), and no significant difference with P value = 0.165 (p 0.05) between the black-tea candy group and non-black tea group.

DISCUSSIONS

The prevalence of xerostomia among the elderly varies globally. In this study, 40% of the elderly experienced xerostomia (mild, moderate and severe). There were 13.3% of subjects complained of having severe xerostomia are which finding is similar to the previous research showing that 19.1% of elderly subjects had dry mouth is 19.1%.[12] Xerostomia in the elderly can be triggered by various factors including poor health, drugs, radiation therapy, stress, depression, and anxiety.[13] Xerostomia is different from hyposalivation. Xerostomia refers to the condition where the quantity and quality of saliva decrease, while in hyposalivation, the decrease in the amount is physiological from aging.[14] Hyposalivation in the elderly can decrease the health of their oral cavity because saliva helps the natural oral cleansing from food.[15] Hyposalivation in elderly treatments includes mechanical salivary stimulation and gustatory stimulation by chewing candy or by using ingredients that can increase the production of saliva in salivary glands.[16]

Black tea was measured in this study for its potential as an alternative treatment for hyposalivation which causes dry mouth in the elderly. The results of this study indicate that chewing jelly candy can increase saliva volume compared to the control group. Black-tea Jelly candy shows a more significant increase in saliva production compared to the use of non-black tea jelly candy. The black tea content in jelly candy can increase the amount of salivary gland production. Bitter taste from tannins in black tea stimulates the gustatory reflex on the tongue, thereby increasing the salivary flow rate and saliva volume. The combination of mechanical and gustatory stimulation when chewing black tea jelly candy may lead to better

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results compared to non-black tea jelly candy.Saliva secretion can increase due to stimulation of the stomatognathic muscles due to the chewing process. This is what stimulates jelly tea candy which can increase saliva volume mechanically. However, research on the use of black tea to increase saliva volume is still limited. Previous research only presented the potential of black tea in increasing the salivary flow rate.[7,8] Salivary secretion can increase due to the perception of taste that stimulates the taste buds in the lingual papilla.[17]

CONCLUSIONS

Based on the results of this study, it could be concluded that black tea has the potential in increasing the saliva volume production that can be used as an alternative treatment for dry mouth of xerostomia in elderly.

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RESEARCH ARTICLE

Characteristics of Leukemia Pediatric Patients with Oral Manifestations at Abdoel Wahab Sjahranie Hospital Samarinda

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ABSTRACT

Background: *Leukemia is a common malignancy in children and occurs when changes in normal cell regulatory processes lead to proliferation of hematopoietic stem cells. Leukemic patients have a higher susceptibility to dental and oral diseases such as mucositis and xerostomia due to damage by chemotherapeutic agents to oral mucosal cells which have a high mitotic index.* ***Objective:*** *To determine the characteristics of leukemia in children with oral manifestations at the Abdoel Wahab Sjahranie Hospital Samarinda which is the main referral hospital in the province of East Kalimantan.* ***Materials and Methods:*** *This research is descriptive with cross-sectional method using medical record data as the subject based on the specified criteria. Data were grouped by type of leukemia, age, gender, nutritional status and oral manifestations.* ***Results:*** *A total of 1,330 cases of Leukemia in 2017-2021 with 12 suitable respondents. There were cases with male gender (58.3%) and 0-5 years of age which were comparable to those of 6-18 years (50%). The type of acute lymphoblastic leukemia was the most common in this study with a frequency of 83.3%. Mucositis (58.3%) was the most common manifestation of people with normal nutritional status (41.7%) and laboratory results stated the average of leukocytes was 45,700/uL, hemoglobin was 10.4 g/dl, and platelets was 117,600/mm^3. A total of 66.6% of respondents had received chemotherapy.* ***Conclusion:*** *Oral manifestations can occur due to leukemia or side effects of chemotherapy, the importance of multidisciplinary and comprehensive treatment between pediatricians and pediatric dentists in managing the dental health of leukemia patients.*

Keywords: *Leukemia, Oral Manifestations, Mucositis*

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INTRODUCTION

Leukemia is a common malignancy in children that occurs when normal cell regulatory processes changes leading to the proliferation of hematopoietic stem cells in the bone marrow.[1] Leukemia is also referred to as a disease that is associated with mutations in genes that control the growth of blood cells[2]. The main cause of this leukemia has not been ascertained. Some of the possible risk factors include lifestyle such as smoking, alcohol consumption, and obesity. Environmental factors that also play a role in the risk of leukemia are chemotherapy, radiation exposure, Human T-cell leukemia virus-1, and some jobs that involve chemicals. Family history and age also play a role in a person's risk of developing leukemia[3,2]. Patients often complain of easy bruising and bleeding. The patient looks pale and tired and has fever, local infection, and dyspnea[4,5]. Bleeding is one of the clinical manifestations of leukemia. The most common locations for bleeding are the skin, eyes, mucous membranes of the nose, gastrointestinal tract, and gingiva[6].

Leukemia and its respective therapies can have an impact on oral health[7]. Diseases of the oral cavity are a reflection of systemic status where oral symptoms or manifestations can be a danger sign of a systemic manifestation such as leukemia[8]. The most common oral manifestations are mucositis, opportunistic infections, gingival inflammation, gingival bleeding, xerostomia, and carious lesions. Mucositis is the most debilitating oral manifestation in children receiving cancer therapy and is common in leukemia patients receiving chemotherapy due to the direct effects of chemotherapeutic agents that destroy oral mucosal cells[9]. Leukemic patients have a higher susceptibility to dental and oral diseases such as mucositis and xerostomia due to damage by chemotherapeutic agents to oral mucosal cells which have a high mitotic index[10]. From the explanation above, the researcher is interested conducting a descriptive study on the characteristics of leukemia in children with oral manifestations at the Abdoel Wahab Sjahranie Hospital Samarinda, which is the main referral hospital in the province of East Kalimantan.

MATERIALS AND METHODS

This type of research is a descriptive study with a cross-sectional method using a retrospective approach aimed at knowing the description of oral manifestations in pediatric leukemia patients at Abdoel Wahab Sjahranie Hospital, Samarinda. The population of this study were all pediatric patients (0-18 years old) who were diagnosed with leukemia and have signs of manifestation of the oral cavity based on clinical and laboratory results by Pediatrician and Pediatric Dentist at Abdoel Wahab Sjahranie Hospital Samarinda. Abdoel Wahab Sjahranie is goverment-owned hospital in Samarinda, East Kalimantan. Currently, Abdoele Wahab Sjahranie hospital is a Class A Teaching Hospital with plenary accreditation from the Hospital Accreditation Commission (KARS). The research sample was obtained through purposive sampling technique, namely all pediatric patients (0-18 years) who were diagnosed with leukemia and have signs of manifestation of the oral cavity based on clinical and laboratory results by Pediatrician and Pediatric Dentist at Abdoel Wahab Sjahranie Hospital Samarinda who underwent hospitalization during 2017 - 2021 and meet the inclusion and exclusion criteria set by the researcher. This research was conducted from August to October 2021.

The research work procedure was carried out by collecting secondary data obtained from the medical records of the Abdoel Wahab Sjahranie Hospital, Samarinda. The data obtained were grouped by type of leukemia, age, gender, nutritional status, and oral manifestations. The data obtained will be analyzed by Univariate Analysis to analyze each variable from the research results to produce the frequency distribution and percentage of each

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table. All data will be obtained using Microsoft Word and Microsoft Excel and then presented in the form of tables and narratives.

RESULTS

Based on the research that has been done, there are 1,330 cases of Leukemia in 2017-2021 with the total number of respondents obtained based on the inclusion and exclusion criteria totaling 12 respondents.

Table 1. Distribution of respondent characteristics by gender and age

Characteristics	Quantity (n=12)	Percentage
Gender		
Male	7	58.3%
Female	5	41.7%
Age (years)		
0-5 years	6	50%
6-18 years	6	50%

Table 1 shows the frequency of respondent's gender, as many as 7 male respondents (58.3%). Then the frequency of the age of the respondents is the same, namely 6 respondents in the 0-5 year age group (50%) and 6 respondents in the 6-18 year age group (50%).

Table 2. Distribution of respondents by type of leukemia

Characteristics	Quantity (n=12)	Percentage
Acute Lymphoblastic	10	83.3%
Acute meiloblastic leukemia	2	16.7%
Chronic myeloblastic leukemia	0	0%

Table 3. Distribution of respondents based on oral manifestations

Characteristics	Quantity (n=12)	Percentage
Mucositis	7	58.3%
Pulp necrosis	1	8.3%
Gingivits	1	8.3%
Gangren radix	1	8.3%
Dental caries, pulpitis	1	8.3%
Acute periodontitis, multiple pulp gangrene	1	8.3%

Table 2 shows the frequency of respondents with acute lymphoblastic leukemia type more than acute myeloblastic leukemia as many as 10 respondents (83.3%). Table 3 shows the frequency of oral manifestations experienced by the most respondents was mucositis, namely 7 respondents (58.3%), followed by pulp necrosis, gingivitis, gangrene radix, dental caries and pulpitis, acute periodontitis and multiple gangrene of the pulp with 1 respondent each (8.3%).

Table 4. Distribution of respondents based on nutritional status

Characteristics	Quantity (n=12)	Percentage
Obesity	0	0%
Over nutrition	1	8.3%
Normal	5	41.7%
Malnutrition	4	33.3%
Poor nutrition	2	16.7%

Table 4 shows the frequency of nutritional status experienced by most respondents, namely normal nutrition, namely 5 respondents (41.7%), followed by malnutrition by 4 respondents (33.3%), poor nutrition by 2 respondents (16.7%), and over nutrition by 1 respondent (8.3%).

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Tabel 5. Distribution of respondents based on laboratory result

Characteristics	Quantity (n=12)	Percentage
Leukocytes	45.7	91.09
Hemoglobin	10.4	2.10
Platelets	117.6	137.93

Table 6. Distribution of respondents based on chemotherapy

Characteristics	Quantity (n=12)	Percentage
Haven't received chemotherapy	4	33.3%
Have received chemotherapy	8	66.6%

Table 5 shows the mean value of leukocytes was 45,700/uL, hemoglobin was 10.4 g/dl, and platelets was 117,600/mm^3. Table 6 shows the number of leukemia patients who have received chemotherapy as many as 8 respondents (66.6%) and 4 respondents who haven't received chemotherapy (33.3%).

DISCUSSION

Oral manifestations in leukemia patients can occur as a result of the disease process or the therapy being undertaken[11]. Oral manifestations that occur in patients receiving chemotherapy are influenced by various factors such as therapeutic content, therapeutic dose, duration of therapy, such as patient age, oral hygiene, history of periodontal disease. These factors will affect the incidence of mucositis, reduced salivary flow (which will lead to xerostomia), pain (due to neurotoxicity), opportunistic infections (such as oral candidiasis), and bleeding gums[12]. In this study, most of the leukemia patients were male, namely 58.3%. In line with a studyin Indonesia[13] which stated the same thing that the incidence of leukemia in children was mostly boys as much as 58.8%. The characteristics of the subjects of this study based on age were the same, namely 5 years as much as 50% and > 5 years as much as 50%. A similar study conducted in Brazil showed pediatric leukemia patients with oral manifestations at the age of 9 years as many as 55.5%, 10-15 years as many as 44.4% and stated that the younger the patient, the greater the vulnerability of the oral mucosa to the effects of chemotherapy where more than 90% of children under 12 years with leukemia have oral complications[12]. This study also shows that the nutritional status of most pediatric leukemia patients is normal as much as 41.7%, followed by malnutrition 33.3%, and malnutrition 16.7%. This is contrary to previous research which stated that the nutritional status of pediatric leukemia patients with the most oral manifestations was normal nutrition 52.9% followed by over nutrition as much as 23.5%[13].

This study showed the most types of leukemia experienced by patients were ALL as much as 83.3% and AML as much as 16.7%. Agreed with previous studies that most leukemia in pediatric patients <15 years is ALL 80% compared to AML 17% and CGL (Chronic Granulocytic Leukemia) 3%[13].

Oral manifestations that occurred in patients who had not received chemotherapy were 33.3% and 66.6% in patients who had received chemotherapy. There are several approaches to classifying oral manifestations in leukemia patients, the most widely used classification is the division of oral manifestations which are called primary complications, secondary complications, and tertiary complications. Primary complications occur as a result of the disease process resulting from infiltration of oral structures such as the gingiva and bone[14]. Oral lesions are the most common manifestation or first symptom of leukemia that makes patients come to health facilities[15]. Secondary complications are related to the direct effects of radiation or chemotherapy, such as thrombocytopenia, anemia, and granulocytopenia leading to a tendency to bleed, more susceptible to infection, and ulceration. Tertiary complications are side

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effects of the given therapy and systemic conditions after therapy, for example, ulceration, mucositis, taste changes, candidiasis, bleeding gums, xerostomia, dysphasia, trismus, etc[14]. Oral mucosal ulcers are the most common manifestation patients with leukemia patients and usually result from the direct effect of chemotherapeutic agents on oral mucosal cells. Bacterial invasion followed by severe neutropenia plays an important role in the development of oral ulcers. Characteristics of ulcers are large, irregular, smelly, and surrounded by pale mucosa due to anemia and lack of inflammatory response. Prolonged bleeding in leukemia patients may result from chemotherapy-induced myelosuppression, drugs, and thrombocytopenia. Thrombocytopenia <20,000mm3 can cause spontaneous gum bleeding[16].

This study showed that the most common oral manifestation was mucositis as much as 58.3%. Mucositis is the oral manifestation with the highest prevalence regardless of the chemotherapy phase. This is similar to the study conducted by 12, which found mucositis as the most common manifestation of 26.5%, followed by gum bleeding 23.4%, and pale mucous membranes 14.7%. A higher prevalence of caries, opportunistic infections of herpes and candidiasis, temporomandibular joint arthritis, and osteolytic lesions of the mandible may occur[8]. Suggest oral manifestations in leukemia patients based on the type of leukemia. In patients with ALL, oral manifestations may include pallor of the mucosa, bleeding gums, ecomosses, and colli lymphadenopathy. Whereas in AML patients, the most common oral manifestations were gum bleeding, oral ulceration, and gingival hyperplasia[16].

In patients receiving chemotherapy, the incidence and severity of oral manifestations depend on the therapy received, where drugs that affect DNA synthesis, such as methotrexate and cytabirine, will be more likely to trigger oral manifestations. The frequency of oral manifestations is more common in the first week after receiving antineoplastic therapy[7].

Oral management in pediatric patients with leukemia consists of pre-therapy, during therapy, and post-therapy. Pediatric leukemia patients are recommended to undergo orofacial examination when the diagnosis is first made, to eliminate potential infection and prevent the risk of dental and oral disease associated with systemic complications. Furthermore, the pediatric dentist team and the pediatric oncology team can communicate with each other for a treatment plan. Pre-therapy that can be done is preventive such as advising to maintain oral hygiene by brushing teeth 2 times a day and using dental floss. The type of toothbrush used depends on the patient's platelets, if the platelets are >50,000/mm^3 use a soft-bristled toothbrush, 20,000-50,000/mm^3 use an extra soft bristle toothbrush, and <20,000/mm^3 use a sponge tooth or moist gauze. Food-related education is also necessary, patients with leukemia need to avoid sticky food, contain sucrose, and can irritate the oral mucosa. The use of sodium bicarbonate or saline mouthwash should be considered to reduce the incidence of oral mucositis in leukemia patients[7].

Oral manifestations that can occur when patients receive chemotherapy are gingival bleeding, xerostomia, candidiasis and bacterial or viral infections, which can make brushing teeth almost impossible. Oral management that can be given during therapy is to replace the toothbrush with pads that have been moistened with water, sodium bicarbonate or chlorhexidine. Patients should rinse with cold water as often as possible to keep the mouth clean and reduce the risk of opportunistic infections. The use of lip balm can also be given. Vomiting as a side effect of chemotherapy can cause decalcification of the enamel and irritation of the oral tissues, so it is necessary to educate the oral cavity with water. Mucositis as the most common oral manifestation can be treated by maintaining oral hygiene every 2-4 hours with gauze moistened with water. Rinsing the oral cavity with 0.9%

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saline solution or sodium bicarbonate can increase the comfort of the patient's oral cavity[7].

After the patient completes chemotherapy, in addition to a check-up with a pediatrician, a check-up with a pediatric dentist is required every 3-6 months. Oral management and routine control can play a role in preventing relapse[7]. In addition, disorders of odontogenesis have relevant psychological effects and can interfere with children's quality of life, especially considering the orofacial abnormalities that can occur in pediatric leukemia patients, namely enamel hypoplasia, stunted tooth growth, abnormal tooth/root formation, and disturbances in jaw growth[7,8].

Based on the results of the research and discussion that has been described, it can be suggested that it is necessary to collect more complete medical record data so that it can minimize the occurrence of data errors during research. As a writer who is also a clinician, believe that the number of patients with oral manifestations at the Abdoel Wahab Sjahranie Hospital Samarinda is more, but because of the system in collecting medical records, the number of samples that the author gets is not following the field and the need for education and socialization by relevant agencies and health workers to the community about the importance of maintaining oral and dental health in leukemia patients, so that mothers and families of patients can play an active role in maintaining and caring for children's health. Further studies with more sample sizes and analytical studies related to oral manifestations in leukemia patients need to be done.

CONCLUSION

Oral health of leukemia patients is a reflection of systemic status. Oral manifestations can occur due to leukemia or side effects of chemotherapy. In this study, the characteristics of leukemia patients with the most oral manifestations were male, with leukemia type ALL, normal nutritional status, had received chemotherapy, and the most oral manifestations experienced by patients was mucositis. Oral management should start when the patient is diagnosed with leukemia by a pediatrician. The importance of multidisciplinary and comprehensive treatment between pediatricians and pediatric dentists in managing the dental health of leukemia patients starting from before therapy, during therapy, and after therapy.

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RESEARCH ARTICLE

Comparison Between Compression Strength of Composite Resin with and without Stamp Technique

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ABSTRACT

Background: *This study aims to determine whether there is a difference in compression strength between resin composites that use the stamp technique and those that do not use the stamp technique.* ***Objective:*** *To identify the effect of the stamp technique with occlusal matrix on the compression strength and compare it with the one without stamp technique.* ***Materials and methods:*** *This study used an occlusal matrix from a transparent impression made of silicone to print the occlusal teeth. This transparent impression was attached to the resin surface composite prior to polymerization and remained on the surface until polymerization ended. The advantage of using this transparent occlusal matrix is that the light cure can penetrate through the transparent layer of the impression. It can be used to isolate oxygen during polymerization.* ***Results:*** *The average compression strength of composite resin with the stamp technique was 128.5300 ±17.23023 MPa, while composite resin without the stamp technique was 91.2460 ±8,72802 MPa.* ***Conclusion:*** *This study showed the difference between the two test groups, where the resin composite using the stamp strength had a higher compression strength.*

Keywords: *Composite Resins, Compression Strength, Oxygen Inhibited Layer, Polymerization, Stamp Technique*

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INTRODUCTION

Composite resin is one of the restorative materials used in dentistry. Composite resin requires polymerization. This stage is crucial as it affects the mechanical characteristics of composite resin, one of which is compression strength. This strength greatly affects the composite resin since a great compression strength can withhold chewing and occlusion load.[1]

The polymerization process on composite resin is very much related to polymerization shrinkage that can affect the mechanic characteristic of composite resin. If the composite resin has low compression strength, it will easily fracture and not last long. The low hardness of composite resins can also cause a decrease in resistance to be worn-out so that the composite resin becomes more easily broken.[2]

In addition to shrinkage during the polymerization process, composite resins also experience a formation of an unpolymerized layer. The composite resin contains arranged matrix consisting of monomers with high mobility. By using a light cure, these monomers will turn solid and hard with the polymerization process. Free radicals, formed as a result of interaction between a light cure and initiator on composite resin, will react with monomers, forming a long polymer bond.[3,4] During the light-curing process, the composite resin is exposed and in contact with oxygen in the room. It causes oxygen to bond and oxidizing free radicals. The result of the oxidation of free radical is known as peroxide radical and has low reactivity to monomers, causing the reaction of the polymerization to obstructed. Consequently, a specific layer is formed called the oxygen inhibited layer (OIL).

OIL is a layer resembling a gel formed due to the delayed monomer polymerization. OIL's composition is almost identical with resin composition that is not hardened with subtraction of total initiator.[5] OIL can add the risk caused by polymerization shrinkage. It can reduce the number of monomers that become polymer called degree of conversion (DC). DC is frequently used as an indicator of mechanical characteristic endurance of adhesive materials.[6]

Stamp technique is a technique for dental restoration classes I and II with accurate occlusal anatomy. This technique is recommended for cases where caries are clearly seen during a routine clinical or radiography examination on teeth with marginal ridge and whole occlusal anatomy. Furthermore, it also can be performed in very small cavities.[7,8] By using the stamp technique, the operator doesn't need to spend time creating dental occlusal anatomy. The contours are also more accurate compared to common carving techniques. In addition to saving time in the carving technique, the stamp technique with the occlusal matrix can isolate composite resin from oxygen contamination, making the OIL layer smaller than the usual technique. It occurs since the composite resin will be polymerized with an occlusal matrix attached to teeth so that the composite resin will not be in contact with oxygen in the room. This study aims to identify the effect of the stamp technique with occlusal matrix on the compression strength and compare it with the one without stamp technique.

Previous studies show a satisfying result for aesthetic and time management among dentists, as using stamp technique can reduce the time needed to do occlusal adjustment, finishing, and polishing. Though the disadvantage of this technique is that it can be done to certain lesions and condition, it is an ideal technique compared to the conventional technique.[9]

MATERIALS AND METHODS

This study is an experimental laboratory. It included 10 samples divided into two groups with different treatments so that each group consisted of 5 samples. Sample making and measurement of compression strength were carried out at the Mechanical Engineering

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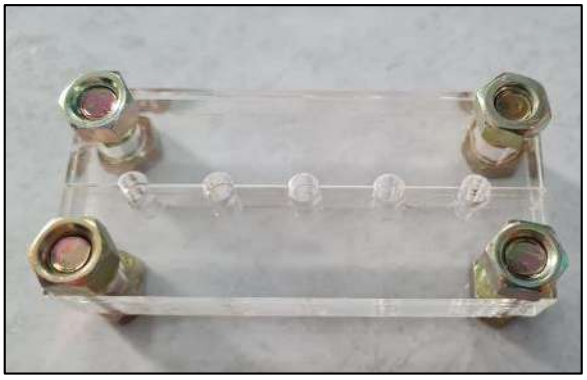
Laboratory of Vocational School, Gadjah Mada University. This study was conducted in November 2021.

Materials

A mold of cylinder acrylic with a diameter of 5 mm and a height of 15 mm was made to form composite resin samples. This study used a bulk-fill flowable (Bulk-Flo) as composite resin. The transparent impression was made from silicone (Any-Flex) and applied to a mica using dental cartridges.



Picture 1. Acrylic cylinder mold

Picture 2. Dental cartridge, clear impression, and composite resin

Methods

The compression strength of the 2 test groups was measured using Controlab TN20MD Universal Testing Machine (UTM) until the samples fractured. The diameter of the composite resin was re-measured because not all samples had the same size, although the available mold was all size in 5mm. The measurement was used to identify the compression strength of each sample. After all diameter samples were recorded, the compression strength measurement was conducted.

Picture 3. Universal Testing Machine

The data obtained were analyzed using the Shapiro-Wilk test to dentify whether the data were normally distributed. The statistical data analysis was processed using an independent t-test for normally distributed data, while Mann-Whitney was for the data which was not normally distributed.

Group A

Transparent silicone used as the occlusal matrix was applied to the surface of composite resin samples. If there were remnants of the composite resin from the mold, it would be cleaned using a cotton bud. The polymerization used LED light cure for 40 seconds with matrix still on the surface of the composite resin.

Picture 4. Clear impression is applied in the surface of composite resin as an occlusal matrix

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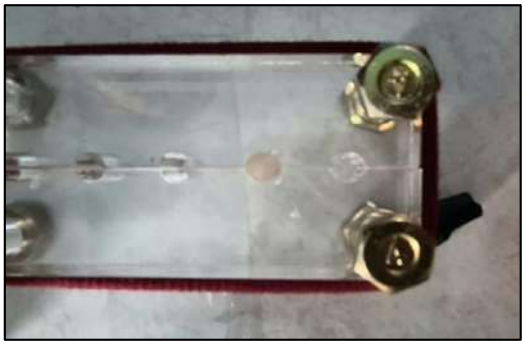
Group B

The composite resin contained in the metal mold was polymerized using an LED light cure for 40 seconds with composite resin exposed to the free air.



Picture 5. composite resin placed inside cylinder mold

RESULTS

The result of the compression strength measurement using a Universal Testing Machine (UTM) can be seen in Table 1 and 2. Based on the graphic, it can be seen that the compression strength in a sample group with a stamp technique was higher than the one without the stamp technique.

Table 1. The Measurement result using UTM

Sample	Diameter (mm)	Pmax (N)
A_1	4,95	2890
A_2	5,04	2690
A_3	5,16	2180
A_4	5,02	2630
A_5	5,00	2360
B_1	5,07	1950
B_2	5,11	1720
B_3	4,97	1810
B_4	5,04	1610
B_5	5,07	2050

Sample	Compression Strength (MPa)	
	Group A	Group B
1	150.25	96.64
2	13.90	83.91
3	104.30	93.35
4	132.95	80.74
5	120.25	101.59
Average	128.53	91.246

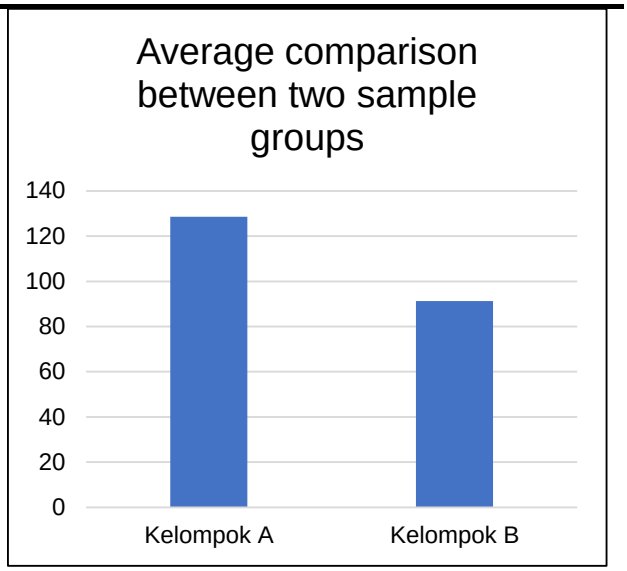


Figure 6. Average comparison between two sample groups

Normality test was conducted with method Shapiro-Wilk method listed in Table 2. The Shapiro-Wilk normality test showed that the data were normally distributed (sig>0.05).

Table 1. Normality test results

	Shapiro-Wilk		
	Statistics	df	Sig.
Group A	,978	5	,923
Group B	,941	5	,671

After the normality test was carried out, the data were analyzed statistically using an independent t-test. The results of the independent t-test can be seen in Table 3. Based on the table of homogeneity test, it was shown that the homogeneity was 0.222 > 0.05. It indicated that the data was homogeneous. Furthermore, the independent t-test showed a significance value of 0.003 (p <0.05). It indicated a difference in compression strength between group A and group B. Group A had higher compression strength with an average value of 128,5300 compared to group B with an average value of 91.2460.

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Table 2. Analysis result of the measurement of the two sample groups

		Levene's Test for Equality		T-test for Equality of Variances				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Compression Strength	Equal variances assumed	1,756	,222	4,316	8	,003	37,28400	8,63781
	Equal variances not assumed			4,316	5,926	,005	37,28400	8,63781

DISCUSSION

Compression strength is one of the important mechanical characteristics. The higher the compression strength is, the higher the filling resistance against fracture will be. Therefore, it is important for filling to have the optimal compression strength. This study aims to identify the effect of the stamp technique using the occlusal matrix on compression strength and compare it to the one without the stamp technique. Based on the results (Table 5), it can be seen that there was a significant difference between the compression strength on composite resin using the stamp technique and without the stamp technique. The statistical results of the independent t-test showed the average compression strength of composite resin with the stamp technique was 128.5300 ±17.23023 MPa, while composite resin without the stamp technique was 91.2460 ±8,72802 MPa. In other words, composite resin has a higher compression strength when oxygen is isolated during polymerization.

The result of this study is in line with the research by Robertson et al. (2016), revealing that the percentage of polymerized monomer would be higher when the composite resin was polymerized and isolated from oxygen. Although the study used the mylar strip, the function was similar to the occlusal matrix by isolating oxygen during polymerization. This aspect is caused by the involvement of oxygen in the polymerization so that there is a smaller number of modified monomers into the polymer chain. The minimal monomer residue can create the composite resin's better mechanical characteristic, making it recommended to be used on the dental surface holding the higher burden, such as posterior teeth.[10]

The monomer residue remains a controversy. Several studies revealed that the existence of monomer residue precisely increases the interlayer shear strength from a composite resin and causes more durable adhesion. Meanwhile, no OIL affects the bonding strength and causes adhesion failure. Therefore, the layer of the oxygen resistor must be left intact after polymerization.[4] Furthermore, another study also identified that OIL on the adhesive material system of single-step self-etching produces shear strength of composite resin against high dentin compared to the one without OIL.[11]

Some other studies revealed the opposite. For instance, the research conducted by Zakiyah et al. (2018) identified the effect of glycerin on the rough composite resin surface. The study explained that glycerin played a role as a blocker of oxygen on the composite resin surface so that the OIL could be minimized. The research result showed that the value of rougher surface significantly belonged to a group of composite resin applied with glycerin before the polymerization. In terms of health aspects, OIL can influence the oral cavity condition as the monomers in composite resin containing BPA can cause toxicity. The use of a rubber dam, longer radiation, and glycerin is highly recommended for reducing monomer residue.[12]

Based on the study, it can also be concluded that the stamp technique can reduce monomer residue as the occlusal matrix on the technique could play a role as a barrier between composite resin and oxygen. In other words, the stamp technique can increase the compression strength of composite resin. Apart from OIL, a case study on the use of the stamp technique with micro brush stated that the stamp technique could reduce composite resin porosity.[13] It can

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be linked with research that discussed the effect of porosity on composite resin. Thus, it can be concluded that macroporosity is responsible for one of the causes of fracture on the interlayer composite resin.[14]

One of the perceptible and feelable OIL characteristics is the existence of a shiny and greasy layer when the composite resin surface is touched. The characteristic was found when the surfaces between the two sample groups were compared. The sample with the stamp technique has no shiny, greasy layer, while those with the stamp technique were shiny and greasy. It aligns with a study revealing the shiny, greasy layer. It even felt a little sticky and could result in discoloration and fracture of the composite resin.[15]

Based on the study, the stamp technique is beneficial for increasing the mechanical characteristics of composite resin. Therefore, the aspects that can interfere with the mechanical characteristics of the composite resin, such as monomer residue and porosity, could be minimized by using this technique. A further study is suggested to examine whether OIL is beneficial or detrimental to composite resin and how much the ideal percentage of OIL is for composite resin, also to scrutinize unidentified confounding factors in this research and consider the factors in the data analysis. Further study is also suggested to identify whether the stamp technique can be applied to other filling materials, such as glass ionomer cement (GIC) and explore how the mechanism of the light cure can penetrate the transparent occlusal matrix. A further study is suggested to use the packable composite resin as it is more resistant against fracture.

CONCLUSION

Compression strength is one of the important mechanical characteristics of filling. The higher the compression strength is, the higher the resistance of the filling material to hold the load will be. One of the methods to increase the compression strength of composite resin identified in this study was by using the stamp technique in the occlusal filling formation. The stamp technique is an innovation aiming to shorten the occlusal formation. The composite resin with an occlusal made using the stamp technique had a higher compression strength than the one without the stamp technique.

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RESEARCH ARTICLE

Correlation of Parenting Styles and Oral Health Behavior of Children with Down Syndrome in Banjarmasin

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ABSTRACT

Background: *Parental, Down syndrome is a trisomy chromosomal genetic disorder that leads newborn child having more than one chromosome so that could interfere the normal growth of the body due to an excess of protein level. Children with Down syndrome have different oral health problems compared to the general population. They need assistance to maintain their oral health because of mental and physical deficiencies as well as limitations in optimally cleaning their teeth.* ***Objective:*** *To analyze the relationship between parenting styles and oral health behavior of children with Down syndrome in Banjarmasin Special Needs School, Indonesia.* ***Materials and Method:*** *This is an observational analytic study with cross-sectional approach. Sample was taken using simple random sampling technique and a cross-sectional sample formula obtained for 32 respondents. The instrument used a parenting style questionnaire and a behavioral modification questionnaire for children's oral health.* ***Results:*** *Democratic (87.5%) compared switch order parenting styles. It was found that there were more children with Down syndrome in the category of moderate behavior (59%) than children with good behavior (38%) and poor behavior (3%). The results of the Somers'd test data analysis obtained a significance value of 0.034 ($p<0.05$) and the correlation value obtained was 0.571, which means that the correlation strength is moderate with a positive correlation direction (unidirectional).* ***Conclusion:*** *The more democratic the parents use as parenting style the better the oral health behavior of children with Down syndrome will be.*

Keywords: *Parenting style, Children With Down Syndrome, Oral health, Health Behavior*

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INTRODUCTION

Parental Down syndrome is a trisomy chromosomal genetic disorder that leads newborn child having more than one chromosome so that could interfere the normal growth of the body due to an excess of protein level. Children with Down syndrome are easily recognized because they have specific physical signs, such as relatively short bodies, small heads, flat noses resembling Mongolians, and intelligence levels below normal children.[1]

The incidence of Down syndrome in Indonesia itself is 1 in 600 live births.[2] The results of the National Institute of Health Research and Development (Riskesdas) show that there is an increase in cases of Down syndrome in children aged 24 to 59 months in Indonesia. Down syndrome cases in 2013 in Indonesia were 0.13% and in 2018 they were 0.21%.[3]

Children with down syndrome have different oral health problems compared to normal children. Oral health is an essential integral part of general health. Poor oral health can have far-reaching consequences for overall wellness.[25] According to a study conducted by Sarheed in Saudi Arabia in 2015, the prevalence of poor oral hygiene in children aged 7 to 12 years with down syndrome was 87.5% higher than in normal children. Gingivitis also affects 91% of children aged 6-20 years with Down syndrome and among children aged 11 years 46.9% have more gingivitis than normal children. syndrome which is classified into the group of children who have oromotor function disorders and it is found that 10% of children with down syndrome have a poor quality of life. Children with down syndrome need help from their parents or caregivers to maintain dental and oral health because they have mental and physical deficiencies and limitations to optimally clean their teeth.[4,5]

Parents shape the behavior and attitudes of children by providing examples, parenting patterns, and interpersonal interactions in the family.[7] Parenting style are interactions between children and parents during parenting. Parenting patterns given by parents to children will reflect behavior that is applied by parents to achieve certain goals, for example, parents of children with Down syndrome train their teeth brushing skills and use fluoride-containing toothpaste to maintain the child's oral hygiene. Overall, it can be said that parenting influences behavior related to children's dental health, while there are still many parents who are not aware of the impact of parenting and the behavior they provide will have an impact on children's dental and oral health.[7] According to Quek's research in Singapore in 2020, as many as 26.7% of parents with permissive parenting almost every day do not make sure their children brush their teeth before going to bed while parents with democratic parenting only 7% who do not make sure their children go to sleep without brushing their teeth.[6,7]

The results of a preliminary study conducted by researchers at Special Schools in Banjarmasin City are known to rarely carry out oral dental health counseling and promotion in Banjarmasin City Special Schools, the last dental and oral health counseling and promotion was carried out in 2014. conducted a study in the city of Banjarmasin about parenting on the oral health behavior of children with Down syndrome. Based on the background that has been described, the prevalence of poor oral hygiene in children aged 7 to 12 years with Down syndrome is 87.5% higher than normal children and by following per under the mission of the Faculty of Dentistry, University of Lambung Mangkurat, namely conducting research that refers to the priority needs of local communities, researchers are interested in researching "The Relationship of Parenting Style to Oral Health Behavior in Children with Down syndrome" which will be carried out at SLB Banjarmasin City.

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MATERIALS AND METHODS

This study is an analytic observational study with a cross-sectional method that has been declared ethically feasible by the Health Research Ethics Commission, Faculty of Dentistry, Lambung Mangkurat University with No.017/KEPKG-FKGULM/EC/III/2022. The population in this study were all children with Down syndrome in SLB Banjarmasin City which consisted of 6 schools, namely SLB Harapan Bunda Banjarmasin, SLB Plus Madana Dun Ya Banjarmasin, SLB Negeri Pelambuan Banjarmasin, SLB Negeri 2 Banjarmasin, SLB Negeri 3 Banjarmasin and SLB BC Paramita. Graha Banjarmasin. The total population was 39 children with Down syndrome. The research was conducted in January-May 2022. Samples were taken using a simple random sampling technique. The number of samples was taken using a cross-sectional sample formula and obtained as many as 32 children with down syndrome. The inclusion criteria in this study were parents who had children attending special schools in Banjarmasin City who had Down syndrome and were healthy. Exclusion criteria in this study included parents who did not agree to the informed consent and did not fill out the questionnaire.

Measurement of parenting styles using the Parenting Styles and Dimension Questionnaire (PSDQ). This questionnaire consists of 32 items with 3 types of parenting styles, namely democratic, permissive and authoritarian.[8] The measurement of oral health behavior of children with Down syndrome was measured using a questionnaire on the modification of oral health behavior. The category of dental and oral health behavior questionnaire was divided into 3 groups, namely behavior in the good category, moderate category, and poor category.[9] Both questionnaires have been tested for validity and reliability in the POTADS community (Union of Parents of Children with Down Syndrome) in South Kalimantan as many as 30 parents. Bivariate analysis used a nonparametric test, namely the Somers' D test method, to see the relationship between parenting style and oral health behavior of children with Down syndrome.

RESULTS

Table 1. Characteristics of respondent

No.	Characteristics	(n)	(%)
1.	Gender		
	Girl	17	53%
	Boy	15	47%
	Total	32	100%
2.	Last Education		
	Elementary School	4	13%
	Junior High School	4	13%
	Senior High School	14	43%
	Bachelor	10	31%
	Total	32	100%
3.	Age		
	26-35 years	8	25%
	36-45 years	10	31,3%
	46-55 years	9	28,1%
	56-65 years	5	15,6%
	Total	32	100%

In this study, there were 32 children respondents, including their parents. The child respondents were 15 boys (47%) and 17 girls (53%). Respondents of parents have the following characteristics, most of them took high school as their last education as many as 15 people (43%) and most of the parents in late adulthood, aged 36- 45 years as many as 10 people (31.3%).

Table 2. Types of Parenting Styles

Parenting style	Amount	Percentage
Democratic	28	87,5%
Permissive	4	12,5%
Authoritarian	0	0%
Total	32	100%

The type of parenting style with the highest number of 28 people (87.5%) had a democratic parenting style and none of the parents in SLB of Banjarmasin City had an authoritarian parenting style.

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Table 3. Categories of Child Oral Health Behavior

Behavior	Amount	Percentage
Good	12	38%
Moderate	19	59%
Poor	1	3%
Total	32	100%

The most children's dental and oral health behavior was in the sufficient category as many as 19 children (59%) and the least was the poor category behavior with 1 child (3%).

Table 4. Cross Distribution Between Gender of Children on Parenting

Child Gender	Parenting Style		Total
	Democrati	Permissiv	
Girl	15 (53,6%)	2 (50%)	17 (53,1%)
Boy	13 (46,4%)	2 (50%)	15 (46,9%)
Total	28 (100%)	4 (100%)	32 (100%)

The results showed that the most democratic parenting for female children (52.6%) and the permissive parenting pattern was the same between girls and boys with as many as 2 children (50%).

Table 5. Cross Distribution Between Parents Education and Parenting Style

Parents Education	Parenting Style		Total
	Democrati	Permissiv	
Elementary School	2 (50%)	2 (50%)	17 (53,1%)
Junior High School	4 (14,3%)	0 (0%)	4 (12,5%)
Senior School	13 (46,4%)	1 (25%)	14 (43,8%)
Bachelor	9 (32,1%)	1 (25%)	10 (31,3%)
Total	28 (100%)	4 (100%)	32 (100%)

The results showed that parents who had the most democratic parenting education had the most recent high school education as many as 13 people (92.9%) and parents with permissive parenting patterns had the most elementary education (50%).

Table 6. Cross Distribution Between Parental Age and Parenting Style

Parents Age	Parenting Style		Total
	Democratic	Permissive	
26-35 years	8 (28,6%)	0 (0%)	8 (25%)
36-45 years	4 (32,1%)	1 (25%)	10 (31,2%)
46-55 years	8 (28,6%)	1 (25%)	9 (28,1%)
56-65 years	9 (10,7%)	2 (50%)	5 (15,6%)
Total	28 (100%)	4 (100%)	32 (100%)

The results showed that the majority of parents with democratic parenting were 36-45 years old (32.1%) and the majority of parents with permissive parenting were 50-65 years old (50%).

Table 7. Cross Distribution between Gender of Children on Oral Health Behavior of Children with Down syndrome

Child Gender	Dental and Oral Health Behavior			Total
	Good	Moderat	Bad	
Girl	9 (75%)	8 (42,1%)	0 (0%)	17 (53,1%)
Boy	3 (25%)	11 (57,9%)	1 (100%	15 (46,9%)
Total	12 (100%)	19 (100%)	1 (100%	32 (100%)

The results showed that children with Down syndrome who had a good behavior categories were mostly girls (75%), while the most moderate category behavior were boys (57.9%) and poor behavior was only 1 boy (100%).

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Table 8. Cross Distribution between Parental Age on Oral Health Behavior Down Syndrome

Parents Age	Dental and Oral Health Behavior			Total
	Good	Moderate	Bad	
26-35 years	3 -25%	5 (26,3%)	0 0%	8 -25%
36-45 Years	5 (41,7%)	4 (21,1%)	1 -100%	10 (31,3%)
46-55 years	1 (8,3%)	8 (42,1%)	0 0%	9 (28,1%)
56-65 years	3 -25%	2 -40%	0 0%	5 (15,6%)
Total	12 -100%	19 -100%	1 -100%	32 -100%

The result showed that the behavior in the good category is mostly in parents aged 36-45 years (41.7%), the category is quite the most among parents aged 46-55 years (42.1%) and the worst category was from parents aged 36-45 years (100%).

Table 9. Cross Distribution between Parental Education on Oral Health Behavior Down Syndrome

Parents Education	Dental and Oral Health Behavior			Total
	Good	Moderate	Bad	
Elementary School	0 0%	3 (25,8%)	1 - 100%	4 (12,5%)
Junior High School	2 (16,7%)	2 (10,5%)	0 0%	4 (12,5%)
Senior High School	4 (33,3%)	10 (52,6%)	0 0%	14 (43,8%)
Bachelor	6 -50%	4 (21,1%)	0 0%	10 (31,3%)
Total	12 -100%	19 -100%	1 -100%	32 -100%

The results showed that the behavior was in a good category, with the most recent education being a Bachelor (60%), moderate category, the most recent education being Senior High School (71.4%) and category worst educated most recently elementary school (25%).

Table 10. Categories of Child Dental and Oral Health Behavior

Parenting style	Behavior			Total
	Good	Moderate	Bad	
Democratic	12 (100%)	16 (84,2%)	0 (0%)	28 (87,5%)
Permissive	0 (0%)	3 (15,8%)	1 (100%)	4 (12,5%)
Total	12 (100%)	19 (100%)	1 (100%)	32 (100%)

The results showed that children with down syndrome who had good dental and oral health behaviors were mostly obtained from parents with democratic style (100%), while the dental and oral health behaviors of children in moderate categories were mostly from parents with democratic parenting style (84.2%), and dental and oral health behavior of children in the worst category with parents having permissive parenting by 1 person (100%).

The results of the Somers'd test data analysis obtained a significance value of 0.034 ($p < 0.05$), which means that there is a significant relationship between parenting style and oral health behavior of children with down syndrome. The correlation value obtained is 0.571 which means the strength of the correlation is in the direction of positive correlation (unidirectional).

DISCUSSION

Parenting Style

The results showed that the majority of parents had democratic parenting and no parents had authoritarian parenting. This is in line with previous research conducted by Thaibah (2020), that the majority of parents of children with special needs, namely 60%, apply democratic parenting.[10] Democratic parenting is the best parenting pattern with a combination of demands and permits and has a good influence on a child. Democratic parenting is characterized by parental acknowledgment of the child's ability and children are allowed not to always depend on their parents.[11]

The results of observations made by researchers found that most children could take care of themselves such as brushing their teeth

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independently. According to Wiryadi's research (2014), the development of children with Down syndrome is experiencing obstacles because parents are afraid that their children cannot do their activities because parenting makes children lazy to do something, if children with down syndrome in SLB Banjarmasin the majority get parenting Democracy will be good for children because they are allowed not to always depend on their parents so that children with Down syndrome can get used to doing their activities and not always depend on their parents.[1]

The results of this study found that the most democratic parenting style were among female children (52.6%). This is similar to the research of Vyas (2016) which states that there is more democratic parenting in girls than boys because mothers tend to spend more time with girls and are warmer than their sons.[12]

The results of the study showed that the majority of parents with democratic parenting had their last education at Senior High School (46.4%). Parenting style can be influenced by educational factors because education can have a big influence on parenting patterns for their children. Parents with high school education already have a fairly broad understanding of children's development, so they can adjust which parenting pattern is best for their children.[13] The results of observations made by researchers, it is known that parents often attend seminars about children with Down syndrome so that parents have a clear mind. open. This is in line with Miyati's (2021) research, which states that parental education can affect the ability to apply the information received and the majority of educated parents choose democratic parenting.[14]

The results of the study also found that the age of the parents of children with Down syndrome who had democratic parenting was 36-45 years old (32.1%). In that age range, a person will act as a parent who always provides time to educate and care for children and the psychological age has reached maturity.[15] This is in line with Hurlock's theory, namely age is one of the factors that can affect parenting, parents aged young people tend to prefer democratic and permissive parenting.[11,15]

Oral Health Behavior in Children

The results of this study indicate that children with Down syndrome in SLB Banjarmasin City who behave in oral health care in the sufficient category (59.4%), good category (37.5%), and bad category (3.1%). These results indicate that oral health behavior in children with down syndrome is mostly in the moderate category. Some indicators of oral health behavior of children in the adequate category are children who consume sweet drinks and food once outside their meal hours, parents who do not take them to the dentist when their child has toothache but give painkillers, children drink sweet drinks/milk 1-4 times a week, children brush their teeth less than 2 times a day. The results of this study are in line with the research of Dynasty (2018) which states that the oral health behavior of children with Down syndrome is mostly included in the sufficient category at 73.33%.[16]

Most of the dental and oral health behaviors in the good category were found in girls (75%), while the bad categories were found in boys (100%). This is in line with Adhi's research (2013), which states that dental and oral hygiene in children with special needs is better for girls than boys. which are difficult to train and difficult to communicate, making it difficult for parents to apply oral health behavior to their children.

The results showed that the majority of the respondents in the early elderly were those aged 46-55 years (42.1%). This is because age is a factor that affects a person's knowledge, then parental knowledge is important in forming behavior that supports and does not support oral hygiene in children. This is in line with research conducted by Novianty (2020), the majority of parents of children who fall into the adequate category in terms of maintaining oral health for

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children with Down syndrome are elderly/elderly parents.[18]

Oral health behavior is quite a majority category of parents with the last education of Senior High School (52.6%). In contrast to the behavior of oral health in the good category, most of the parents with the latest education were Bachelor (50%), while 1 child (100%) with Down syndrome who had bad behavior was obtained from parents whose last education was Elementary School. According to Ulfah (2018), the majority of parents with the last education Senior High School have better knowledge about oral hygiene practices.[19] The level of education affects a person to understand and receive good dental and oral health education. Lack of parental knowledge about the importance of oral health problems will shape attitudes and behaviors that ignore oral health care which will cause problems in the child's oral cavity.[20] People with higher levels of education will have good knowledge and behavior about health which will affect their health, behavior for a healthy life.[21] In line with research conducted by Emilda (2023), the education level of parents increased as the children's dental health and attitudes.[22]

The Relationship f Parenting Styles to Oral Health Behavior in Children with Down Syndrome

The results of the cross-distribution between parenting styles and the oral health behavior of children with down syndrome in good categories were all obtained from parents with democratic parenting (100%), while the moderate category behavior was mostly from parents with democratic parenting (84.2%), and behavior in the bad category of parents with permissive parenting (100%), compared to children with permissive parenting, none of which was included in the category of good oral health behavior. This is like research by Howenstein (2015) showing that democratic parenting has a consistently positive impact on children and finding that democratic parenting is associated with good oral cavity behavior and fewer dental caries compared to the other two parenting styles.[23]

Democratic parenting is the best parenting because oral health behaviors that are included in the good category are only found in democratic parenting. However, it was also found that democratic parenting with oral health behavior was in the sufficient category, this was because children with down syndrome had retarded physical and mental abilities, causing limitations in their ability to maintain oral health, due to limited motor, sensory, and intellectual potential.[24] So it is difficult to train which makes it difficult for parents to order their children to brush their teeth and teach how to maintain dental health in children with down syndrome.

The analysis of the relationship between parenting style and the oral health behavior of children with Down syndrome that was carried out at the SLB Banjarmasin City by using the Somers' D correlation test found that there was a relationship between parenting style and oral health behavior. This is in line with research conducted by Quek (2020), which states that parenting has an impact on children's oral hygiene behavior.[25] Democratic parents are firm but still protect their children, for example, allowing children to eat and drink sweet drinks with certain limitations and times, in contrast to permissive parents who tend to free their children's choices such as allowing children to eat or drink sweet drinks without being limited, parents also do not make sure their children brush their teeth every day. Quek's research also shows that parents with permissive parenting are less likely to monitor their children's diet.[6]

CONCLUSION

Based on the results of this study, it could be concluded that parenting styles found more children with down syndrome with parents who have a democratic parenting style compared to the permissive type and no parents with

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authoritarian parenting. Behavior of children's oral health, it was found that there were more children with Down syndrome in the category of moderate behavior than children with good behavior and poor behavior. There is a relationship between parenting styles on oral health behavior in children with Down syndrome in Special Schools (SLB) Banjarmasin City, namely the more democratic the parenting pattern of parents will affect the oral health behavior of children with down syndrome.

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CASE REPORT

Management of Ellis Class II Fracture in Young Permanent Maxillary Central Incisor

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ABSTRACT

Background: *Tooth fracture is a condition of missing or lost fragments of a complete tooth. Tooth fracture usually occurs simultaneously with another oral injury.* ***Objective:*** *This case report discussed the management of Ellis class II fractures on an immature permanent central incisor of a patient who reported to Jenderal Achmad Yani University (Unjani) Dental Hospital.* ***Case:*** *An 11-year-old girl revealed a broken upper left tooth, sensitive to cold drinks that interfered with her appearance one year ago. The patient had a good general condition, no abnormalities during an extraoral examination, and a history of pain on the lower back tooth since a year ago.* ***Case Management:*** *Management of Ellis class II fracture in young permanent central incisor was conducted by using a class IV composite resin restoration.* ***Conclusion:*** *The management of Ellis class II fracture should be conducted holistically and systematically with subjective, intraoral, extraoral, and adjunctive examinations which should be performed correctly and considering the child's psychology.*

Keywords: *Composite Resin, Oral Trauma, Tooth Fracture*

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INTRODUCTION

Oral trauma is a condition of injury to the hard tissues of the teeth, pulp, alveolar bone, periodontal tissue, gingiva, and oral mucosa.[1] Oral trauma is a common occurrence, which comprises 5% of all traumas.[2] Trauma to permanent teeth increases in school children with active exercise and playing activities. A study stated that 30% of children experienced trauma to their primary teeth and 22% of children experienced trauma to the permanent teeth.[3] Other than that, the most prevalent dental trauma was luxation, which accounted for 51% and fracture injuries 49%.[4] In both primary and permanent dentition, maxillary incisors are the most frequently affected teeth by trauma.[5]

One common type of dental trauma that affects both primary and permanent teeth is coronal fractures of the anterior teeth. Different degrees of harm to the teeth or the soft tissues that support them are involved in traumatic dental injuries.[6] Age is a significant factor in tooth fracture. [5] Trauma mostly occurs in 7-12 years old children and predominantly affects boys than girls with a ratio of 1.68:1.[7] Meanwhile, The most frequent issue among young children is trauma to the anterior teeth. The maxillary central incisors are the teeth that are most commonly impacted.[8]

Sports are one of the main causes of tooth fractures. Children between the ages of 9 and 10 are also active and effective, but because they are still growing and developing, they lose their kinetic coordination and are unable to accurately judge speed and danger. Tooth fracture can occur directly or indirectly. Direct tooth fracture occurs when a hard object directly contacts the tooth, while indirect fracture occurs when there is an impact to the chin, which causes the mandibular tooth to bump into the maxilla with a sudden large force.[4,6,7]

To ensure a positive outcome, proper diagnosis, treatment planning, and follow-up are crucial. Management of tooth fracture should be done promptly because time is an important factor in maintaining the vitality of injured tissues. Furthermore, first aid highly determines the treatment outcome, especially related to the prognosis of a tooth, pulp tissue, and periapical tissue. It consists of diagnosing, managing, and choosing the correct materials. Dental trauma management is complicated, and it can get more complicated for patients who are growing.[2,6,9]

This case report discussed Ellis class II fracture on an immature permanent tooth of a patient who reported to Jenderal Achmad Yani University (Unjani) Dental Hospital. Hopefully, this case report will shed new enlightenment regarding Ellis class II fracture in young permanent maxillary central incisor which often occurs and is found in clinics. However, if it is not handled properly it will affect the vitality of the teeth which in turn can affect the stomatognathic system.

CASE AND CASE MANAGEMENT

First Visit

An 11-year-old girl reported to Unjani Dental Hospital with a complaint of a broken upper left front tooth, sensitive to cold drinks, and interfered with her appearance since a year ago. The tooth fractured when she fell during bicycling and landed on the asphalt when she was 8 years old. During that time, she received a wound in the oral region. However, the tooth was not mobile and not sensitive. Therefore, she did not visit the dentist. However, the patient felt that the tooth affected her appearance after a year and caused sensitivity, thus she wanted her tooth to be restored with a tooth-colored restoration. During the first visit, subjective and objective examination was conducted and found that the patient was in a mixed dentition period, normal occlusion, Ellis class II fracture on tooth number 21, tooth 75 was persistent, and caries on tooth 55, 12, 24, 36, 44, and 46. The extraoral examination was uneventful and the patient had a good general condition. She was given prophylaxis and an adjunctive examination of a panoramic radiograph (Figure 1). The overall

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diagnosis result from the examination is presented in Table 1.

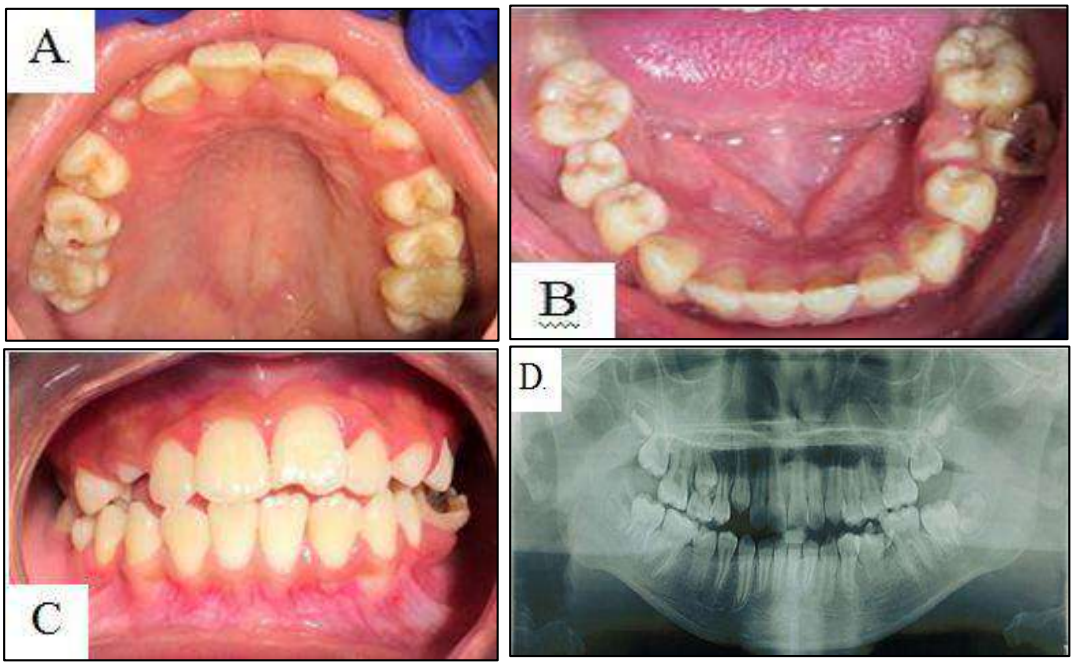

Figure 1. A Maxilla B. Mandibula C. Occlusion D. Panoramic radiograph (Before Treatment).

Tabel 1. Examination Result, Diagnosis and Treatment Plans

Tooth	Examination Result	Diagnosis	Treatment Plans
Tooth 55	Caries occlusal dentin V : +, P/t : -, M: -	- Pulpitis Reversible - Caries media	- Extraction infiltration
Tooth 12	Caries proximal email V : +, P/t : -, M: -	- Caries email	- Observasion
Tooth 21	Ellis Class II Incisal Mesial fracture V : +, P/t : -, M: -	- Pulpitis Reversible - Ellis Class II fracture	- Restorasion class IV resin composite
Tooth 24	Caries occlusal dentin V : +, P/t : -, M: -	- Pulpitis Reversible - Caries media	- Restorasion class I resin composite
Tooth 36	Caries occlusal dentin V : +, P/t : -, M: -	- Pulpitis Reversible - Caries media	- Restorasion class I resin composite
Tooth 75	Persistence V : -, P/t : -, M: grade 2	- Pulp necrosis - Phisiological root resorption	- Extraction infiltration
Tooth 44	Caries occlusal dentin V : +, P/t : -, M: -	- Pulpitis Reversible - Caries media	- Restorasion class I resin composite
Tooth 46	Caries occlusal dentin buccal V : +, P/t : -, M: -	- Pulpitis Reversible - Caries media	- Restorasion class I resin composite

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Second Visit

On the second visit, extraction was performed on tooth 75 with II degree of mobility. Afterward, an X-ray was performed on tooth 21 with Ellis class II fracture. OHI was always given to the patient regarding how to perform oral hygiene. The result of the periapical radiograph revealed a partial loss of the mesial side of tooth 21 which involved the enamel and dentin resembling a fracture. The periapical and lamina dura was within normal limits (Figure 2).

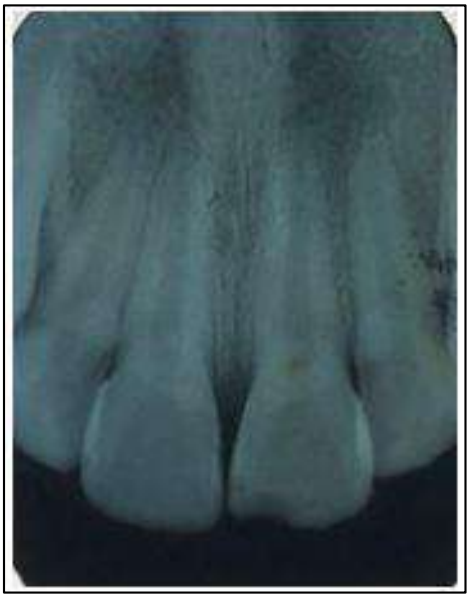

Figure 2. Periapical Dental

Third Visit

On the third visit, a composite resin class IV restoration was given to tooth 21 using the following materials and equipment, i.e. ash 49, etch, bonding, light cure, cotton roll, celluloid strips, polishing strips, enhance, and silicon rubber burs. The first step performed was shade determination, which includes A3 for dentin and A2 for enamel with a composite (Beautifill II dental hybrid composite). Afterward, the fractured area was smoothened using a diamond fissure bur and a long bevel was placed on the labial side and a short bevel on the palatal side. Then, the cavity was cleaned, and the working area was isolated using a cotton roll. The enamel was etched using a micro brush for 15 seconds and rinsed with water and dried under moist condition. Then, the enamel-dentin area was bonded with a micro brush and light-cured for 10 seconds. A celluloid matrix and palatal matrix were placed to prevent restoration material from touching the adjacent tooth. Then, the composite was inserted into the cavity using an incremental method with 2 mm thickness layered with enamel-dentin-enamel shade and was shaped according to tooth anatomy and light-cured for 20 seconds. The proximal side was polished with a polishing strip and the labial side was polished with an enhanced bur and finished with a silicone rubber bur. The occlusion was checked using articulating paper (Figure 3).

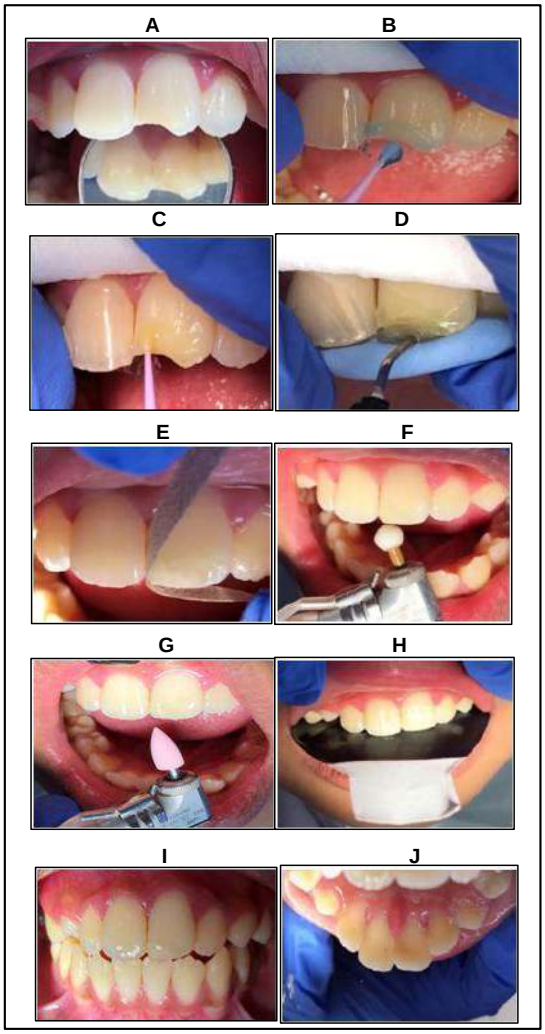

Figure 3. A. Long bevel in labial incisal and short bevel in palatal incisal. B. Etching application. C. Bonding Application. D. Incremental composite application. E. Polishing with polishing strips. F. Polishing with Enhance. G. Polishing with silicone rubber. H. Check the occlusion with articulating

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paper. I. Post restoration during occlusion. J. Palatal post-restoration.

Fourth Visit

The patient was recalled a week after the restoration procedure. There was no complaint, and an objective examination of percussion, mobility, and vitality test did not show any abnormalities. The restoration was in good condition with no erosion or damage. The patient was always given OHI to maintain oral hygiene. The restoration was evaluated a month later (Figure 4).

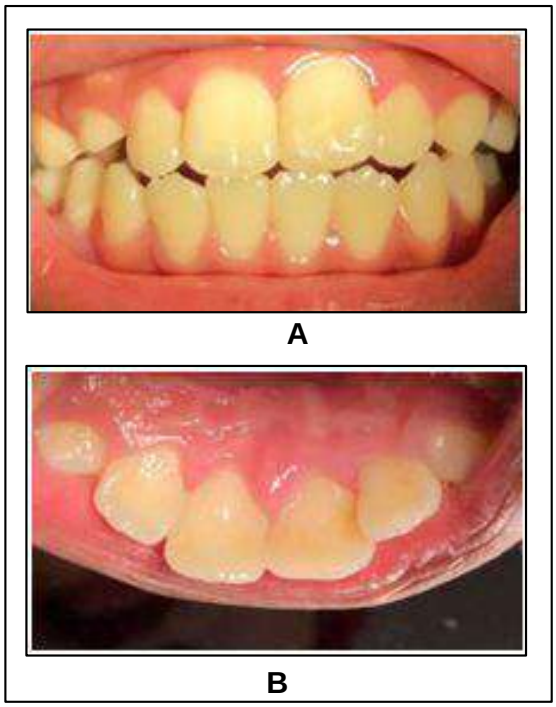

Figure 4. A. Labial surface post restoration class IV teeth 21 after 1 week. B. Palatal surface post restoration grade IV teeth 21 after 1 week

Fifth Visit

The patient came for a 6-month follow-up. There was no complaint and an objective examination on the tooth, which include percussion, mobility, and vitality test, showed no abnormalities. The restoration was still in good condition without any erosion or damage. The patient was always given OHI to maintain oral hygiene. A periapical radiograph on tooth 21 was performed to evaluate the restoration. The result was uneventful (Figure 5).

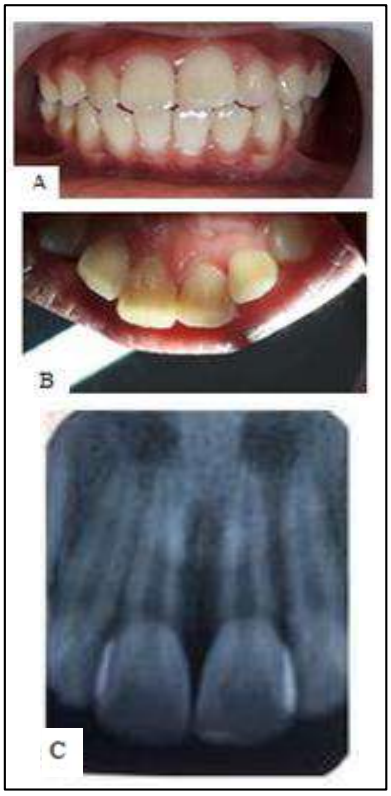

Figure 5. A. Labial surface post restoration Class IV teeth 21 after 6 months. B. Palatal surface post restoration Class IV teeth 21 after 6 months. C. Periapical radiografh after 6 months.

DISCUSSION

The patient was an 11-year-old girl with a crown fracture on tooth 21 due to falling when bicycling. Her mouth bumped onto the asphalt when she was 8 years old. The younger age group of eight to ten years (8-10 years) sustained much fewer injuries (25.4%), whereas eleven and twelve years (11-12 years) accounted for 74.6% of the children who suffered dental injuries in the current study. The most commonly affected tooth is the maxillary central incisor because it is the most prominent tooth vulnerable to direct blow.[1,2,5,10,11] Zainal (2021) reports that the teeth most frequently involved are the maxillary central incisors and the most common causes are falls, fights, sports, traffic accidents, and domestic violence.[12]

When treating traumatic oral injuries, incorrect initial assessment frequently leads to

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treatment errors. In-depth yet speedy and effective clinical and radiographic evaluations, as well as diagnostic testing, must be performed.[13] The first step in this diagnostic process is to determine whether dental luxations are present. Next, we will attempt to determine whether a crown or coronoradicular fracture is present, and using this decision-making tree, we will determine the accurate diagnosis that will enable the creation of the most suitable treatment plan.[14]

A clinical examination of the case showed that the tooth was sensitive to cold foods. A radiograph of tooth 21 showed lost incisal mesial part of the enamel to dentin. The periapical region was normal and the vitality test showed positive. This stated that exposed dentin could irritate the pulp, thus causing free movement of the dentin tubules in reaction to temperature, pressure, and tactile stimuli to compress odontoblasts, nerve endings, fibroblasts, and blood vessels. This condition can be diagnosed as reversible pulpitis caused by Ellis class II fracture on tooth 21.[15]

The tooth was restored using composite resin without pulp capping because the fracture did not expose the pulp or near the pulp. In this case, a material with satisfactory esthetic quality, good color stability, and polish ability was chosen. Composite resin is a plastic material, durable to masticatory force, and can attach well to tooth tissue. However, it has several drawbacks, which were sensitive technique and requires good isolation.[16-18] This is in accordance with research by Lakshmi (2022) which states that about 61.54% of them had restoration as the choice of treatment for Ellis Class 2 fracture.[19]

Evaluation of tooth with Ellis class II fracture was conducted after a week, a month, and 6 months post-procedure. A radiograph evaluation revealed a radiopaque image resembling the restoration material on the mesial side of tooth 21 that was still complete. This means that the restoration was in good condition. Furthermore, there was no complaint during objective and subjective examinations.

According to APPD, evaluation of Ellis class II fracture should be conducted after 6-8 weeks and a year after trauma. An evaluation of fractured teeth includes any complaints, response to pulp vitality test, any apical periodontitis, and the continuity of physiological root development.[20] Most medical professionals use electrical stimulation and heat during a post-trauma evaluation to determine the pulp's state of health.[19] These tests can be performed using a variety of methodologies and have varying indications (with different materials). It is therefore easier to select the appropriate test for each individual if one understands the concepts underlying tests, their varieties, and their clinical variations.[21]

CONCLUSION

Management of Ellis class II fracture should be conducted holistically and systematically by considering intraoral and extraoral examinations, adjunctive examination, and child's psychology. These are all related to the prognosis of tooth trauma management.

Conflict of Interest

The authors declare that there are no conflicts of interest.

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CASE REPORT

Oral Complications Due to Medication in Stevens-Johnson Syndrome Patient with Systemic Involvement

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ABSTRACT

Background*: Stevens-Johnson Syndrome (SJS) is a drug-induced hypersensitivity reaction involving mucocutaneous with various trigger factors including drugs and herpes simplex virus.* ***Objective:*** *This case report aimed to discuss oral complications due to medication in SJS patients with systemic disease involvement.* ***Case:*** *A 51-year-old man was referred to the Department of Oral Medicine, Faculty of Dentistry, Padjadjaran University, at Hasan Sadikin Hospital from the dermatology and venereology department complaining of pain in the oral cavity, especially when eating and drinking two months before, with a history of phenytoin, salbutamol and theophylline therapy. Extraoral examination showed erosive lesions and tended to bleed serosanguinolenta crusts on the lips. Intraoral there were erosive lesions and white plaque on the tongue, buccal mucosa, labial mucosa, and palate, as well as dental caries and calculus. Blood examination showed low hemoglobin, hematocrit, erythrocytes, lymphocytes, monocytes, SGOT, and sodium levels, while HbA1c, random, fasting, and 2 HPP glucose levels were high. Reactive Anti-HSV-1 IgG and rheumatoid factor. KOH examination showed positive spores, hyphae, pseudohypha, and budding cells. The diagnosis was SJS-associated oral lesions with HSV-1 virus infection, oral candidiasis accompanied with diabetes mellitus. For diabetes mellitus treatment, he was referred to the internal medicine department.* ***Case Management:*** *The therapy was 0.9% NaCl for lip compress, acyclovir tablet, nystatin oral suspension, chlorhexidine digluconate 0,12% mouthwash, folic acid, and vitamin* B_{12}*. Oral lesions were improved significantly after diabetes mellitus was treated.* ***Conclusion:*** *The SJS patient was susceptible to complications in the oral cavity, especially fungal and viral infections due to the received medication.*

Keywords: *Diabetes Mellitus, Oral Lesions, Stevens-Johnson Syndrome*

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INTRODUCTION

Stevens-Johnson syndrome (SJS) is a life-threatening acute mucocutaneous disease caused by a type 4 hypersensitivity reaction.[1] The lesions involve 10% of the body's surface area and two or more mucous membranes.[2] Severe lesions present with irregular shapes on the body such as purpura, erythematous macules, bullae, and vesicles.[3] The etiology of SJS is still unknown but several predisposing factors can be considered as the cause, such as drugs, allergies, infections, and idiopathic and immune imbalances. The drugs that are thought to be the cause of hypersensitivity reactions are antibiotics, analgesics, anticonvulsants, non-steroidal anti-inflammatory drugs, allopurinol, and antiretrovirals.[4] Histopathologically the mechanism of SJS is keratinocyte apoptosis resulting in epidermal necrosis, subepidermal bullae, and inflammatory infiltrates are also seen.[5]

The clinical features of SJS are erythematous lesions on the skin along with bulla formation, involving the mucosa (eyes, mouth and genitals), fever, malaise, joint pain and sore throat. Oral manifestations are ulcerated lesions on the lips and erosion of the oral mucosa.[6] Generally, the management is to provide electrolyte fluids as a substitute for body electrolytes, skin protection to prevent secondary infection and fluid loss, as well as symptom-based drug administration and immunomodulating therapy such as immunoglobulins and glucocorticoids.[7] The prognosis was assessed using the scorten.[8]

Stevens-Johnson syndrome occurs due to a hypersensitivity reaction to drugs, one of which is Diabetes Mellitus (DM) medication.[9] Diabetes mellitus (DM) is a metabolic disease characterized by hyperglycemia due to decreased insulin secretion, impaired insulin function, or both of them. There are two types of diabetes mellitus, diabetes mellitus type 1 (insulin-dependent) and diabetes mellitus type 2 (non-insulin-dependent). In Indonesia, the highest prevalence of DM is type 2 which reaches 90% of the total number of DM patients in Indonesia.[10] Oral manifestations that may occur in DM patients are dry mouth, periodontal disorders, gingivitis, oral candidiasis, dental caries, burning mouth syndrome (BMS), impaired taste, oral lichen planus (OLP), delayed wound healing, and increased incidence of infection.[11]

Long-term corticosteroids as the therapy for SJS patients, can cause oral complications such as herpes virus and candida infections.[12] Corticosteroids have been used for a long time to treat SJS because of their anti-inflammatory effects.[8,12] This case report aims to discuss oral complications due to medication in SJS patients with systemic involvement.

CASE REPORT

A 51-year-old male patient was referred to the Department of Oral Medicine, Faculty of Dentistry, Padjadjaran University from the Dermatology and Venereology Department, Faculty of Medicine, Padjadjaran University at Hasan Sadikin Hospital, complaining of mouth and lips sore for 2 months before. The dermatology and venereology department diagnosed the patient as SJS ec phenytoin and/or ec salbutamol and/or ec theophylline, discarded COVID-19, and grade II hypertension. History of medication was methylprednisolone, furosemide, cetirizine, ranitidine, folic acid, and vitamin B12.

Table 1. Laboratory test result

Examination	5-Apr-21	22-Apr-21	Normal Value
Hemoglobin	12,7	12,0	14-17,4g/dl
Hematocrit	39,6	35,2%	41,5-50,4%
Erythrocytes	4,6	4,21	4,5-5,9 mil/uL
Leukocytes	14,63	11,2	4,4-11,3 10^3/uL
MCH	26,3	27,6	27,5-33,2 pg
MCHC	32,1	33,7	33,4-35,5%
Rod Neutrophil	1	1	3-5%
Neutrophil segment	85	92	45-73%
Lymphocytes	11	5	18-44%
Monocytes	4	2	3-8%

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HbA1c	-	10,8	4,5-6,2%
RPG	-	558	<140mg/dL
FPG	-	191	70-100 mg/dL
OGTT	-	391	<140mg/dL
SGOT	-	62	
Protein total	-	5,9	6,4-8,2 g/dL
Albumin	-	2,63	3,4-5,0 g/dL
Ureum	-	41,3	15-39 mg/dL
Creatinin	-	1,33	0,80-1,30 mg/dL
Sodium	-	126	135-145 mEq/L
IgG anti-HSV-1	-	Reactive	
Rheumatoid factor	-	Reactive	
Candida preparation	-	Spora(+), pseudohypha(+), budding cell(+)	

Extraoral examination, tend to bleed, serosanguinolenta crusts, dry and exfoliative lower lip. There was also a white with an erythematous base ulcer, 0.2x0.8 cm in size, at the corner of the mouth. During intraoral examination there are multiple white plaques, that could be scrapped off leaving an erythematous area on the dorsum and laterals of the tongue. There were irregular, shallow, reddish base ulcers, 0.2x0.3 cm in size at the lateral and ventral tongue. Multiple white plaques at the buccal mucosa could be scrapped off leaving an erythematous area, as well as multiple, irregular, reddish base ulcers. Multiple white plaques, at the lower labial mucosa, could be scrapped off leaving an erythematous area. White plaque that could be scrapped off leaving an erythematous area at the hard palate, and shallow irregular ulcers, 0.4 cm in diameter, yellowish-white, reddish edges. Multiple white plaques at the oropharynx and soft palate. Dental examination showed caries media on tooth 25, and pulp necrosis on teeth 14,44,15,35,45,46. Plaque and calculus throughout the maxilla and mandible. The diagnosis was Suspected HAEM, suspected pseudomembranous candidiasis, angular cheilitis, traumatic ulcers at regions 35 and 46, aphthous-like ulcers of the palate, chronic apical periodontitis, and generalized chronic marginal gingivitis.

CASE MANAGEMENT

Patients were referred to the Department of Oral Medicine, Faculty of Dentistry, Padjadjaran University at Hasan Sadikin Hospital in the outpatient department after completion of inpatient treatment The management of this patient was to maintain his oral hygiene as well as communication, information, and education. The patient was instructed to brush his teeth and clean his tongue at least 2 times a day, compress the lips with 0.9% NaCl, to swish and swallow nystatin oral suspension 4 times a day @ 2 ml, gargling with 0.12% chlorhexidine digluconate mouthwash 3 times a day. Anti-HSV1 igG and KOH function tests were carried out. The KOH function test is an examination procedure to detect fungal infections in the skin or oral mucosa. This test uses the chemical compound potassium hydroxide (KOH) in its execution.

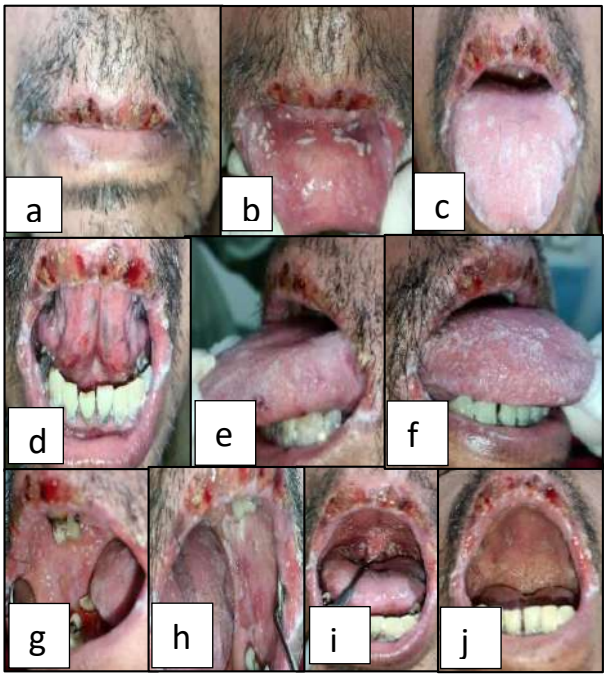

Figure 1. a, b, c, d, e, f, g, h, i and j. Extraoral: serosanguinolent crusts and ulcers at the corners of the mouth. Intraoral: multiple white plaques, which could be scrapped off leaving an erythematous area, and multiple ulcers.

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The patient is not hospitalized but instead undergoes outpatient treatment. After 2 weeks, treated with drugs at the initial visit, on the 14th-day visit, anti-HSV1 IgG was reactive, while the KOH test on the dorsum of the tongue showed spores, hyphae, pseudohypha, and budding cells. Intraorally, no improvement of the white plaque on the dorsum of the tongue (figure 2), the patient did not take nystatin regularly because he was afraid that it would run out quickly. He was instructed to take medication regularly and maintain his oral hygiene. At this visit, the management was of acyclovir tablets, folic acid, vitamin B12, nystatin oral suspension, and 0.12% chlorhexidine digluconate mouthwash. The medication was under supervision by the dermatology and venereology department due to a history of hypersensitivity reactions.

Figure 2. The clinical picture on the 1st control, pictures a1,a2, b1,b2, c1, c2, and d1, d2: white plaque was increased in the dorsum of the tongue, upper and lower labial mucosa, and buccal mucosa. Picture e1, e2, f1, and f2: white plaque was decreased in the hard palate and orofaring

On day 28th visit (2nd visit), the patient complained that the white color on the surface of the tongue was increasing. Intraoral white plaque appeared on the entire surface dorsum of the tongue, while the lesions on the right and left buccal mucosa, upper and lower labial mucosa, and the palate had not improved. The dermatology and venereology department suggested discontinuing the nystatin due to suspected hypersensitivity to nystatin, but allergy tests were not conducted due to cost constraints.

Figure 3. The clinical picture on the 2nd, the picture a2 and a3: white plaque on the dorsum surface of the tongue was increased. picture between b2 and b3, c2 and c3, d2 and d3,e2 and e3, f2 and f3: white plaque on the labial mucosa, buccal mucosa, and hard palate were decreased.

On the 42nd day visit, oral cavity complaints had greatly reduced, currently the patient was taking glibenclamide medication prescribed by internal medicine because the level of blood sugar was 558 mg/dL. The patient had discontinued nystatin. Intraoral (figure 4), the white plaque on the dorsum of the tongue was reduced and thinned. Ulcers on the buccal mucosa and palate were healed too.

Figure 4. The picturea3 and a4, b3 and b4, c3 and c4, d3 and d4. the dorsum of the tongue, buccal mucosa and hard palate was improved.

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On the 60th day visit, there were no complaints in the oral cavity. The patient routinely took glibenclamide, cetirizine, methylprednisolone, cyclosporine, and ranitidine. Intraoral there were no lesions in the entire oral cavity (figure 5).

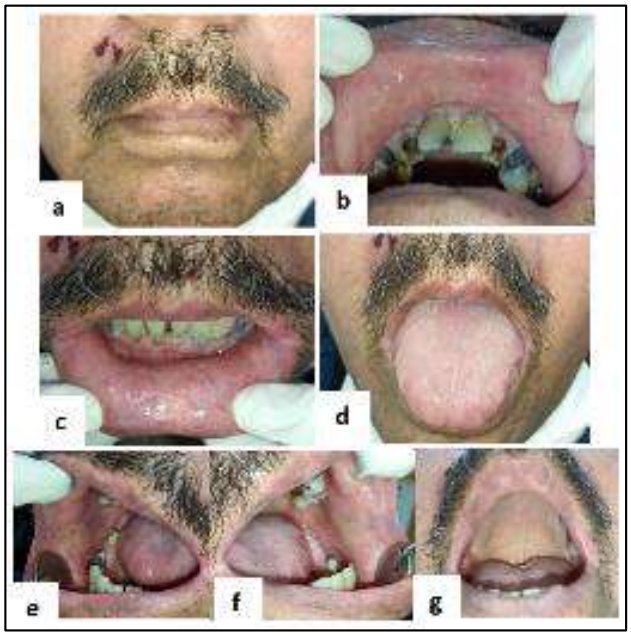

Figure 5. a, b, c, d, e, f, and g. The lesion in the patient's lips, labial mucosa, dorsum of the tongue, buccal mucosa and the hard palate was healed.

DISCUSSION

SJS is a life-threatening acute mucocutaneous disease caused by a type 4 hypersensitivity reaction. Corticosteroid is the gold standard for the management of SJS to save the patient's life.[8] The patient in this case report received therapy from the Dermatology and Venereology Department, in the form of 32 mg methyl prednisolone for 10 days and then tapered off to 16 mg. According to Kumar et al (2018), the recommended dose of corticosteroids is 8-16 mg/day, but if needed, larger doses can be given.[7] Methylprednisolone is known to reduce levels of pro-inflammatory cytokines such as interferon-gamma, TNF, and IL-6 and increase survival rates in SJS patients.[7] Corticosteroids work by suppressing the immune system so that it can cause side effects, namely the patient becomes susceptible to infection.[13] In this case the patient suffered from fungal and viral infection. Oral candidiasis is one of the most common oral mucosal complications in patients with suppressed immune systems.[12] Candidiasis is caused by Candida spp., especially C. albicans, a dimorphic fungal organism that is non-pathogenic in healthy individuals.[14] Oral candidiasis causes discomfort in the oral cavity, pain, loss of taste sensation, causing difficulty in eating, with the clinical picture of white pseudomembranous plaque, this plaque will leave an erythematous area on the base of the oral mucosa after swabbing or scrapping.[15] The patient was also infected with HSV 1 virus showed by the reactive HSV-1 IgG.

The patient's management was nystatin oral suspension, acyclovir tablets, and 0.12% chlorhexidine digluconate mouthwash. After one week of taking the medication, erosive lesions and white plaques on the dorsum of the tongue, buccal mucosa, and labial mucosa were increasing, the dermatology and venereology department recommended discontinuing nystatin oral suspension and acyclovir tablets because they suspected that the patient had a hypersensitivity reaction to both drugs, (allergy tests were not conducted due to cost constraints), but 0,12% chlorhexidine digluconate mouthwash was still continued. Chlorhexidine digluconate is an antiseptic to prevent further infection of oral lesions. Chlorhexidine has broad-spectrum antibacterial activity (for gram-positive, gram-negative, non-spore-forming bacteria, fungi, and viruses). the mechanism of action is by interfering with the binding of the cationic chlorhexidine molecule to the bacterial cell wall and altering the osmotic balance of the bacterial cell resulting in leakage of potassium and phosphorus and inhibiting the bacterial growth. At high concentrations, it is bacteriostatic, while at low concentrations it has a bactericidal effect.[16]

Extensive skin lesions in this patient led to dehydration, this could be seen from the increase in urea and creatinine values, as well as decreased protein and albumin values (Table

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1). Disruption of the continuity of the skin also causes decreasing in protection against foreign objects so that the body is more susceptible to infection. The blood examination showed increasing value of leukocytes, segment neutrophils, and monocytes, this indicated that there was an infectious process in this patient.[4] He was also treated with folic acid 1x1 mg/day and vitamin B12 2x50 mcg/day to support the improvement of oral lesions as well as the anemia. The decreased values of hemoglobin, hematocrit, erythrocytes, and MCHC showed that he was a hypovolemic anemia patient. Vitamin B12 and folic acid were expected to induce erythropoiesis by systemic rehydration. In addition, vitamin B12 and folic acid will form a compound S-adenosylmethionine which plays a role in immune function. They also play a role in cell regeneration and re-epithelialization.[17]

The improvement of oral lesions in this patient took quite a long time, about 60 days. This was due to the systemic condition of the patient who had increased blood sugar level, thus hampering the healing process, although nystatin was discontinued due to suspicion of allergy to nystatin, oral candidiasis can be cured with the use of chlorhexidine diguconate. because as is known, in addition to having an antiseptic effect, chlorhexidine also has an antifungal effect even though at a lower concentration.[18] Diabetes mellitus is a chronic disease that can reduce resistance to microbial infection and reduce the ability of tissues to repair their structure.[19] Endocrine dysfunction and metabolism involving the control of blood glucose levels leads to hyperglycemia. The patient stated that his oral function returned to normal at 60 days of therapy, after being treated for diabetes mellitus so that he could eat well which supported the healing process. Chronic hyperglycemia can trigger immunoregulatory system disorders, thereby increasing the risk of infection, due to decreased chemotaxis, phagocytosis, and microbiocidal power, including in the oral cavity such as oral candidiasis.[20] The collaboration of the medical team between oral medicine specialists, dermatologists, and internal medicine went very well so it contributed to the recovery of this patient.

CONCLUSION

Oral complications due to medication can occur in SJS patients. SJS patients are susceptible to complications in the oral cavity, especially fungal and viral infections due to the received medication. The success of oral lesion therapy in SJS patients is also influenced by the patient's systemic condition, if the systemic condition is not treated it will affect the success of oral manifestation therapy.

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RESEARCH ARTICLE

The Connection Between Recurrent Aphthous Stomatitis (RAS) and Psychological Stress in Patients at RSGM Nala Husada

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ABSTRACT

Background: *The most common oral soft tissue disease at RSGM Nala Husada is recurrent aphthous stomatitis. RAS is a condition marked by inflammation of the orakl mucosa, which manifests as one or more ulcers that recur over time. RAS can be influenced by various predisposing factors, with stress being a common trigger. Stress refers to the body's reaction to challenges or pressures that lead to uncomfortable feelings, which are perceived differently by each person.* ***Objective:*** *To determine the relationship between stress in patients with recurrent aphthous stomatitis at RSGM Nala Husada.* ***Materials and Methods:*** *The population and samples of all RAS patients who visited RSGM Nala Husada were taken by purposive sampling with a total of 100 people. The level of stress experienced by a person measured from the Depresion Anxiety Stress Scale (DASS) questionnaire which consists of 42 questions. Data on RAS were taken from subjective examination and intra-oral examination. Processing of data using correlation test with Spearman test in SPSS program.* ***Results:*** *The results of the Spearman test are a weak correlation, which can be seen from R= 0.115 (Sig = 0.175.> 0.05). A positive R value means that the relationship is in the same direction.* ***Conclusion:*** *In this study there was no significant relationship between psychological stress in RAS patients at RSGM Nala Husada. Therefore, it is necessary to review further the severity, duration and intensity of stress that can trigger the emergence of RAS and reconsider other predisposing factors related to RAS besides stress.*

Keywords: *Depression Anxiety Stress Scale (DASS), Psychological Stress, Recurrent Apthous Stomatitis (RAS)*

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INTRODUCTION

One of the most common oral tissue disorders is Recurrent Aphthous Stomatitis (RAS). RAS is a recurring inflammation of the oral mucosa characterized by the presence of white ulcers. Recurrent aphthous stomatitis (RAS) is classified into three types based on factors such as the number, size, duration, and scarring of the lesions: Minor RAS, Major RAS, and Herpetiform RAS. Minor RAS is the most common type, affecting about 85% of individuals. It usually appears on non-keratinized oral mucosa, including the lips, cheeks, floor of the mouth, and the lower or side surfaces of the tongue. The ulcers in Minor RAS are typically small, with a diameter under 1 cm, often around 4-5 mm, and may number between 1 and 5. Their shape varies with location. Although the ulcers can recur over time, Minor RAS generally heals within 1-2 weeks without causing any scarring.

Major RAS, which occurs less often, accounts for about 10-15% of RAS cases. Although it shares some similarities with Minor RAS, Major RAS ulcers are larger (more than 1 cm in diameter), deeper, and frequently cause scarring. These ulcers can last for several weeks to months and are usually found on the lips, tongue, soft palate, and hard palate, often accompanied by significant pain. [1-3].

RAS herpetiformis only occurs in 5-10% of all RAS cases. Ulcers in RAS Herpetiformis are small (1-2 mm) and appear in multiples (10-100) simultaneously They are typically found on the lateral edges and underside of the tongue, as well as the floor of the mouth. These ulcers are small but cause pain and difficulty in eating and speaking. A single attack of ulcers in RAS Herpetiformis usually lasts about 1-2 weeks, with remission periods between attacks varying. Sometimes these ulcers may coalesce to form larger ulcerated areas, often with erythema[3,4].

RAS is a relatively mild disease, not life-threatening and non-infectious, but RAS can cause pain and discomfort that interferes with masticatory, swallowing, and speech functions. RAS can attack non-keratinizing oral mucosa, namely buccal, labial, lateral and ventral mucosa of the tongue, floor of the mouth, soft palate and oropharyngeal mucosa with a characteristic clinical picture in the form of necrotic ulcers with clear boundaries and surrounded by an erythematous halo[5-8].

The precise cause of recurrent aphthous stomatitis (RAS) remains unclear, but stress is recognized as a contributing factor. A study conducted by Wowor et al. in 2019 identified a significant link between stress and RAS among students in the Dentist Education Study Program at Sam Ratulangi University. This result is consistent with the findings of Kusumastuti in 2023, who observed that stress affects the incidence of RAS in dental professional students at IIK Bhakta. These studies suggest that psychological conditions, such as stress, can contribute to the onset of RAS[9,10].

Diagnosing RAS relies on evaluating the patient's history and the clinical features of the ulcer. Special attention should be given to the patient's history, especially concerning potential predisposing factors. Stress is a key factor closely associated with the condition[11]. When an individual experiences stress, it activates the central nervous system (CNS) through the HPA axis (Hypothalamic Pituitary Adrenal). This activation prompts the hypothalamus to release CRH (Corticotropin Releasing Hormone), which in turn triggers the pituitary gland to produce ACTH (Adrenocorticotropic Hormone). ACTH prompts the production of cortisol and catecholamines. As cortisol levels increase in the bloodstream, the immune system's response becomes less effective. During stress, the rise in cortisol, which binds to receptors on all leukocytes, including lymphocytes, regulates the immune system. High cortisol levels suppress immune function by inhibiting both the phagocytic system and overall immune response. Stress-induced damage to the oral mucosa often results in both acute and chronic inflammation [12].

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MATERIALS AND METHODS

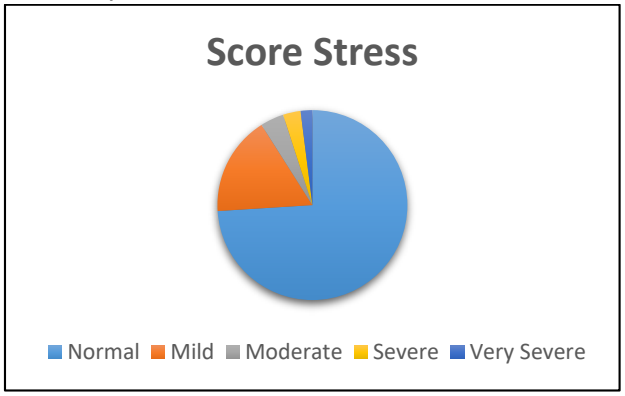
This research is an analytical observational study employing a cross-sectional design and was carried out at the Department of Oral Medicine, RSGM Nala Husada. The research population was all patients in the Oral Medicine Departement of RSGM Nala Husada in 2020. The study included a sample size of 100 participants selected through purposive sampling. Stress levels were assessed using the Depression, Anxiety, Stress Scale-42 (DASS-42), a validated and reliable questionnaire with 42 items aimed at measuring negative emotional states related to depression, anxiety, and stress.[13]. RAS data is taken from the results of subjective and objective examinations by Oral Medicine Specialist. The collected data were analyzed using the SPSS software and processed with the Spearman correlation test, due to the presence of nominal data scales. Analysis is used to obtain a description of each variable and is presented in table form. Data is said to be significant if p<0,05.

RESULT

Table 1. Frequency distribution based on gender

Sex	Frequency	(%)
Male	26	26.0
Female	74	74.0
Total	100	100.0

Table 2. Score stress in the relationship between recurrent aphthous stomatitis and psychological stress in patients at RSGM Nala Husada research



The measurement of stress level is done by giving a Depression Questionnaire, Anxiety Stress Scale-42 (DASS-42). DASS-42 is a psychological measurement tool that is widely used as an initial screening of stress. The DASS questionnaire contains 42 questions. The results of the DASS-42 questionnaire were grouped into 5 groups according to the scores, namely normal 0-14, mild 15-18, moderate 19-25, severe 26-33, very severe >34. Respondents found that the normal condition was 0 and there was severe stress with a score of 34. The results of the stress score can be seen in table 2.

Table 3. The relationship between stress and the incidence of RAS in the study of the relationship between recurrent aphthous stomatitis and psychological stress in patients at RSGM Nala Husada

		RAS	Score Stress
RAS	Correlation Coefficient	1.000	.115
	Sig. (2-tailed)	.	.175
	N	100	100
Score Stress	Correlation Coefficient	.115	1.000
	Sig. (2-tailed)	.175	.
	N	100	100

Based on the results of the analysis test, the Spearman test there is no significant relationship, it can be seen from R= 0.115 (Sig = 0.175.> 0.05). A positive R value means the relationship is in the same direction. can be seen from table 3, it was found that the correlation 0.115 = very weak correlation almost non-existent (Sig =00.000) (Sig <0.05). This indicates that there is no significant association between thrush and stress in this study.

DISCUSSION

Recurrent aphthous stomatitis (RAS) or recurrent aphthous stomatitis (RAS) is an inflammation of the oral mucosa with a clinical picture in the form of single or multiple ulcers that appear repeatedly. Ulcers can appear in various sizes and numbers, so that they can be

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classified into 3 types, specifically minor, major and herpetiform. RAS Minor with shallow, oval, diameter < 1 cm, visible white center, surrounded by an erythematous margin. Mayor RAS is characterized by the presence of round or oval-shaped ulcers with clear boundaries, 1 cm in diameter and accompanied by pain. Herpetiformis RAS is a rare type of focal ulceration of the oral mucosa. The striking feature of this type of RAS is the presence of multiple ulcers, 20 to 200 ulcers, 1-3mm in diameter, round shape, the mucosa around the erythematous ulcer and is expected to be painful[1]. RAS can occur at any age and based on the 2018 report on result of national basic health research, the highest prevalence of RAS is at the age of 19-24 years, which is 9.6% and the lowest is at the age of 3-4 years. The data obtained was that the age range of respondents who experienced RAS was 18-59 years old[6,14,15.]

Several studies have shown that RAS is more common in women than men, one of which is Abdullah's study which showed a higher prevalence of RAS in women than men, with a percentage of 55.4% in women and 44.6% in men. According to the literature, RAS was more common in women, 74 respondents, while 26 respondents were male[15].

The diagnosis of RAS can be made with accurate subjective examination and accurate objective examination. Subjective examination is closely related to the history of RAS. RAS appears recurrently and can change locations in the oral cavity. Subjective examination begins with taking a history, where in the early stages, patients usually report a burning sensation on the oral mucosa about 2 to 48 hours before the ulcer appears. At this stage, the area may already look reddish (erythema). Once the ulcer appears, patients complain of pain at the ulcer site, which can be more intense in large ulcers. In addition to significant pain, patients may also experience discomfort when speaking and eating[1,2,4,14]. The data analysis of this study obtained non-significant results. The non-significant results in this study were influenced by many factors, one of which was due to the background of patients who were not willing to explain in detail about the appearance of their ulcers. In fact, to get the right diagnosis of RAS, it needs to be confirmed by an accurate subjective examination.

To this day, the etiology of RAS is idiopathic or the cause is still unknown. However, there are several predisposing factors that play a significant role in the development of this condition, including genetic predispositions, immune system responses, hormonal imbalances, stress, systemic diseases, local mechanical trauma, viral and bacterial infections, nutritional intake, smoking habits, and allergic reactions. This research specifically examines psychological stress as a triggering factor. During stressful situations, cortisol levels in the blood rise, which can lead to an increase in the number of leukocytes and inflammation, ultimately triggering RAS. Physiologically, stress triggers stimulation of two main systems, namely the sympathetic nervous system and the hypothalamic pituitary adrenal (HPA) axis. Activation of the HPA axis causes the secretion of cortisol, a stress hormone that regulates metabolism and vascular reactivity. Elevated cortisol levels can lead to increased inflammatory activity, which in turn can trigger RASs with higher relapse rates [17]. Stress can cause the body to react via the Hypothalamus-pituitary-adrenal cortex (HPA) axis which is activated by a series of stress reactions that lead to the release of Corticotropin-releasing hormone (CRH) from the hypothalamus and glucocorticoids, including cortisol from the adrenal cortex. Increased cortisol levels are able to regulate components of the body's defense and inflammatory response. Increased salivary cortisol flow, decreased salivary levels, and changes in salivary pH can lead to an imbalance between the host and increased reactive microbial species making them more susceptible to infection in the dental and oral areas[18].

Under stressful conditions, the adrenal cortex secretes cortisol, leading to a reduction in

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the synthesis of IFN-γ and an increase in the formation of IL-10 and IL-4 (type 2 cytokines). This shift results in a greater type 2 cytokine response. Recent studies suggest that this imbalance in type 1/type 2 cytokine levels plays a crucial role in connecting the effects of stress to the immune system. Various immune responses occur in this context, including a decrease in the number of CD4 lymphocytes, an alteration in the CD4 ratio, reduced regulatory activity of CD4 CD25 Tregs, an increase in B lymphocytes, a rise in T cells, a decrease in HSP expression, an enhanced immune complement system, a higher number of NK cells, reactivation and hyperreactivity of neutrophils, decreased expression of anti-inflammatory cytokines produced by Th2 and TGF, and increased expression of pro-inflammatory cytokines such as those produced by Th1, including IL-2, IL-12, IFN-gamma, and TNFα.

In the humoral response, salivary IgA levels in patients with RAS rise during the acute phase and then decrease during the regression and recovery phases. Alongside IgA, levels of IgG and IgM also increase. IgG and complement function together as opsonins to assist each other. IgG possesses effective opsonin properties because phagocytic cells, such as monocytes and macrophages, have receptors for the Fc region of IgG. This interaction enhances the binding between phagocytes and target cells. Consequently, these changes can result in pathological conditions in the oral mucosal epithelial cells, making them more responsive to stimuli[8].

The level of stress can be assessed using the Depression Anxiety and Stress Scale (DASS). This scale includes 42 questions that are intended to evaluate the negative emotional states associated with depression, anxiety, and stress. The stress scale in depression anxiety stress scale consists of 42 questions and is very sensitive to the level of non-specific chronic causes. The stress scale was used to measure the level of relaxation, the appearance of nervous breakdowns, the level of anger, overreaction, and the level of patience. The results of respondents answers based on experience for a week will be evaluated with a stress severity index, and calculated based on a score system. DASS-42 questionnaire were grouped into 5 groups according to the scores, namely normal 0-14, mild 15-18, moderate 19-25, severe 26-33, very severe >34. Respondents found that the normal condition was 0 and there was severe stress with a score of 34[2,14,19]. In this study, there was no relationship between RAS and psychological stress, this was due to the severity of stress and the duration of stress experienced by patients was low or mild.

The non-significant results in this study were also influenced by the many overlapping predisposing factors of RAS, especially in this study genetic, hormonal, allergic and trauma. Genetic factors have an influence on the emergence of RAS almost more than 40%. Patients with genetic RAS from parents can be inherited up to 90%. Genetic factors are related to human leukocyte antigen (HLA). HLA detection can reflect genetic conditions because each individual has different HLA. Several HLA antigens such as HLA-A33, HLA-B35, and HLA-B81 have been associated with an increased incidence of RAS[10,16,20,21]. The hormonal conditions experienced in patients in this study also indirectly affect the predisposing factors of stress. This is another possible cause of insignificant research results. Hormonal factors often occur in women are menstruation, pregnancy, contraceptive use, breastfeeding and menapouse. During menstruation, a decrease in progresterone hormone levels will inhibit the maturation of epithelial cells which will facilitate bacterial invasion so that RAS can occur[16].

Allergic factors are often associated with a higher prevalence of RAS in patients. Immune molecules like immunoglobulins and eosinophil cationic protein (ECP) are key indicators of the body's allergic response. Potential allergens such as certain food ingredients (including milk,

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food additives, carbonated drinks, and nuts), toothpaste components, and dental care products may also trigger allergic reactions[8,20]. Trauma is another significant predisposing factor for RAS. It can lead to edema, cause inflammation of cells, and increase the viscosity of the submucosal extracellular matrix, thereby making RAS more likely to occur. Trauma can be caused by mechanical, chemical, thermal, iatrogenic trauma, such as biting, brushing teeth too hard, consuming hot food, e-cigarettes, sharp dentures, rough dental fillings, sharp tooth root residues, and others[20]. Therefore, the existence of several predisposing factors is also the reason for this study, why the relationship between stress and RAS patients is not significant.

CONCLUSION

The study's results indicate that there is no significant connection between stress and recurrent aphthous stomatitis in patients at RSGM Nala Husada. Further research is necessary with various other triggering factors, a sharper and more accurate subjective examination, a more diverse population, a longer research time so that the results can be used in general to improve the degree of oral health, especially those related to the field of oral disease.

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RESEARCH ARTICLE

The Inhibition of *Cyanobacteria spirulina* Extract on S. Mutans Biofilm as an Ingredient in Mouthwash

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ABSTRACT

Background: *The main cause of dental caries is* Streptococcus mutans (S. mutans)*, to suppress the growth of cariogenic bacteria can be done by using mouthwash containing antibacterial ingredients such as chlorhexidine.* Cyanobacteria spirulina *extract contains compounds that have secondary metabolites which act as antibacterial and antioxidant including tannins, flavonoids, saponins and terpenoids.* ***Objective:*** *This study aimed to find out he inhibition of* Cyanobacteria spirulina *against* S. mutans *biofilm.* ***Materials and Methods****: The research sample consisted of 6 groups. Group K(-) was the* S. mutans *biofilm with aquadest, K(+) was Chlorhexidine 0.2% and four treatment groups (P1, P2, P3, P4), which were* Cyanobacteria spirulina *extract with a concentration of 60 , 70, 80 and 90 mg/ml. The sample was applied to a well microtiter plate, then incubated overnight at 37°C for 1 x 24 hours, then painted with 0.1% crystal violet. After that, it was rinsed with sterile distilled water, then given 0.2 mL of Tween 80 concentration of 2% and measured Optical Density with an ELISA Reader with a wavelength of 570 nm, then biofilm inhibition percentage as calculated.* ***Results:*** *The mean value of the percentage of* S. mutans *biofilm inhibition in group K(+): -131,694(SD 10,758) ; P1: -12,234(SD 2,402) ; P2: 11,076(SD 6,387) ; P3: 19.7020(SD 11,670) ; P4: 40,214(12,057) there were significant differences between P2 and P4 also between P3 and P4.* ***Conclusion:*** Cyanobacteria spirulina *at concentrations of 70, 80 and 90 mg/ml had* S. mutans *biofilm inhibition, while Chlorhexidine 0.2% and* Cyanobacteria spirulina *60 mg/ml did not.*

Keywords: *Cyanobacteria spirulina, Chlorhexidine, Mouth Wash, S. Mutans Biofilm*

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INTRODUCTION

Dental caries is one of the dental health problems experienced by people of all ages. In Indonesia, based on the results of the 2019 Indonesia National Basic Health Research Report, the prevalence of dental caries reached 88.8%. The most common caries-causing micro-organism is *S. mutans*. These microorganisms produce organic acids, especially lactic acid, by fermenting carbohydrates on the tooth surface, resulting in a decrease in salivary pH below 5.5 which results in demineralization of the tooth surface so that dental caries is formed.[1] *S. mutans* is able to produce acids in dental plaque.[2] A colony of microorganisms consisting of several cells of various types of bacteria that adhere to the surface of the teeth is called a biofilm..[3] Bacteria will form a biofilm as a defense to survive in the oral cavity environment so as to make it stronger against immune response attacks from the host and also drugs.[4] The process of biofilm formation can occur through several phases, which are the initiation of bacterial attachment, maturation, colonization and release of biofilm cells.[5] Some conditions that can affect the biofilm formation process include pH levels, nutrition and host defense.[6]

One of the efforts to suppress the high caries rate is to control the number of caries-causing bacteria. This can be done by chemically controlling plaque through the use of mouthwash containing antibacterial ingredients so that it can suppress the growth of cariogenic bacteria.[7] Mouthwash commonly used is chlorhexidine, fluoride and povidone iodine. Chlorhexidine is able to prevent plaque and dental caries because it has a bactericidal and bacteriostatic effect on oral bacteria.[8]

Cyanobacteria are known as "blue green algae" because the bluish color of this species is due to the formation of phycobilin and phycocyanin pigments in certain concentrations.[9] This *Cyanobacteria spirulina* extract contains compounds that have the potential as antitumor, anti-inflammatory, antimicrobial, and antioxidant.[10] The presence of effective antimicrobial properties in Cyanobacteria spirulina extract is due to the content of linolenic acid, synergistic effect of lauric acid.[11] *Cyanobacteria spirulina* contains secondary metabolites that act as antibacterials including tannins, flavonoids, saponins and terpenoids.[12]

MATERIALS AND METHODS

Preparation of solutions by weighing *Cyanobacteria spirulina* powder with sterile distilled water to produce solutions with concentrations of 60 mg/ml, 70 mg/ml, 80 mg/ml, 90 mg/ml. To conduct a biofilm formation detection test on *Streptococcus mutans* bacteria, it is necessary to inoculate Streptococcus mutans bacteria on Congo red agar in a petri dish, incubated at a temperature of 37°C, for 48 hours, under anaerobic conditions. Then checked after 48 hours, if a black colony were formed, it means that the bacterial strain forms a biofilm.

The biofilm of *Streptococcus mutans* which in a well microtiter plate and then it needs to be incubated at 37°C for 24 hours. Then into each well was added a solution of green microalgae *Cyanobacteria spirulina*, then incubated overnight for 24 hours, at 37°C. The contents of each well were aspirated and washed with 0.2 mL of Phosphate buffered saline, 3 times. The biofilm formed and attached to the well was stained using 0.1% crystal violet. After that, it was rinsed using sterile distilled water, then dried. The analysis stage of biofilm formation was carried out by adding 0.2 mL of 2% Tween 80 in each well. Measurement of Optical Density (OD) using ELISA Reader 570nm wavelength.

RESULTS

The average value along with the standard deviation of the Optical Density measurement using an ELISA Reader tool using 570nm wavelength in all groups.

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Table 1. The mean value and standard deviation of *Streptococcus mutans* biofilm inhibition

Group	Replication	Mean	SD
K (+)	5	-131,6940	10,75857
K (-)	5	0	0
P1	5	-12,2340	2,40246
P2	5	11,0760	6,38713
P3	5	19,7020	11,67030
P4	5	40,2140	12,05749

Note:
K (+) : Chlorhexidine 0.2% + the biofilm of Streptococcus mutans
P1 : Cyanobacteria spirulina solutions with concentrations of 60 mg/ml + the biofilm of Streptococcus Mutans
P2 : Cyanobacteria spirulina solutions with concentrations of 70 mg/ml + the biofilm of Streptococcus Mutans
P3 : Cyanobacteria spirulina solutions with concentrations of 80 mg/ml + the biofilm of Streptococcus Mutans
P4 : Cyanobacteria spirulina solutions with concentrations of 90 mg/ml + the biofilm of Streptococcus Mutans

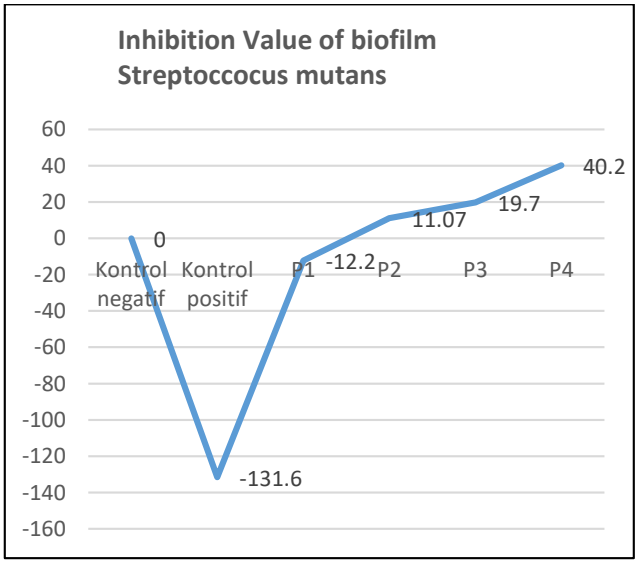

Figure 1. Graph of the inhibition value *Streptococcus mutans* biofilm

Note: K - (Aquades); K+ (Chlorhexidine 0,2%); P1 (solution Cyanobacteria spirulina concentration 60mg/ml); P2 (solution Cyanobacteria spirulina concentration 70mg/ml); P3 (solution Cyanobacteria spirulina concentration 80mg/ml); P4 (solution Cyanobacteria spirulina concentration 90mg/ml).

To find out whether all data were normally distributed, data analysis was carried out by conducted a normality test used Shapiro-Wilk.

Table 2. Result of normality test with Shapiro-Wilk

Group	Sig.
K (+)	0,959*
P1	0,228*
P2	0,376*
P3	0,318*
P4	0,154*

Note: ***** (p>0,05)

In the normality test, the obtained is p > 0.05, this indicates that the data is normally distributed. Because all data are normally distributed, it can be continued with a homogeneity test using the Levene Test.

Table 3. Test result for the variance homogeneity with Levene's test

Levene test	Sig.
2,501	0,075*

Note: ***** (p >0,05)

The results of the variance homogeneity test with Levene's test obtained is p > 0.05, so it can be said that the data in this study are homogeneous. The results of data testing on all percentage values of *Streptococcus mutans* biofilm inhibition obtained that all data obtained is normally distributed and homogeneous, then it can be continued with data analysis using the one-way ANOVA test. This is to find out whether

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there are differences in all research sample groups.

Table 4. The result of *Oneway* ANOVA test

	Sig.
Between Groups	0,000*****

Note: ***** (p < 0,05)

The p < 0,05 was obtained from the results of data analysis using the one-way ANOVA test, this indicates that there are differences in all groups, so to find out in more detail about the differences between each group, for this reason, data analysis is required by conducting an LSD test.

Table 5. The result of LSD test

	K+	P1	P2	P3	P4
K (+)		0,000*	0,000*	0,000*	0,000*
P1			0,001*	0,000*	0,000*
P2				0,163	0,000*
P3					0,003*
P4					

Note: * (p < 0,05)

The results of the LSD test conducted, obtained data p value <0.05 between group K (+) with groups P1, P2 and P3; group P1 with groups P2, P3 and P4; group P4 with groups P2 and P3. From these data it can be said that there are significant differences between: group K (+) with groups P1, P2 and P3; group P1 with groups P2, P3 and P4; group P4 with groups P2 and P3.

DISCUSSION

Cyanobacteria spirulina is a prokaryotic blue-green algae or single-celled organism, is a type of phytoplankton organism that comes from the Cyanophyta group (blue-green algae), where the Cyanobacteria spirulina species is often used for various needs, including as a food additive, industrial raw material, natural feed, pharmaceuticals and also for cosmetics. With a protein composition of 60-70% of the total mass. *Cyanobacteria spirulina* is known to have antimicrobial activity, one of which is against *Staphylococcus aureus (S. aureus)*.[10] In research on the evaluation of microalgae and cyanobacteria as potential sources of antimicrobial compounds, it was found that the dominant compounds identified and purified in the extract were docosahexanoic acid (DHA), oleic acid, linoleic acid and eicosapentaenoic acid (EPA). The presence of these compounds as ingredients in Cyanobacteria spirulina is a potential candidate that inhibits the growth of gram-positive bacteria.[13] Pure antimicrobial compounds produced by Spirulina platensis appear to be more active in inhibiting gram-positive, gram-negative bacteria and unicellular fungi as well as candida albicans.[14]

Cyanobacteria spirulina also has the potential as a strong natural antioxidant, this is because this species contains chlorophyll, phycobiliprotein, phenolic and carotenoid compounds which are able to donate hydrogen atoms to free radical compounds.[10] Dental caries is caused by host interactions which include teeth and saliva, food, time, oral hygiene and microorganisms. *Streptococcus mutans* bacteria are the main microorganisms that cause dental caries.[15] *Streptococcus mutans* has the ability to form biofilms on teeth so that it can cause dental caries which can cause abnormalities in tissues in the oral cavity and body systems. Biofilm is a colony of microbes consisting of both organic and inorganic substrates which are coated with extracellular microbial products to form an intermicrobial matrix. The ability of *Streptococcus mutans* to synthesize glucan homopolymers extracellularly from sucrose is something that plays an important role in the process of initial attachment, colonization and biofilm accumulation on the tooth surface.[16]

In this research wanted to know about the inhibition of *Streptococcus mutans* biofilm against 0.2% Chlorhexidine mouthwash as a

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positive control group and with *Cyanobacteria spirulina* solution with concentrations of 60, 70, 80 and 90 mg/ml respectively as the treatment group. The results showed that a solution of *Cyanobacteria spirulina* with a concentration of 70, 80 and 90 mg/ml had the ability to inhibit the formation of biofilm Streptococcus mutans, this was supported by the research of Winahyu et al (2020) it was found that the *Cyanobacteria spirulina* extract with concentrations of 25%, 50%, 75% and 100%, could be used as an antibacterial against gram-positive bacteria *Streptococcus aureus* in which *Streptococcus aureus* bacteria had the same characteristics. similar to that of Streptococcus mutans.[17] In microalgae lipid compounds there are Fatty Acid Methyl Ester (FAME) which are known as suitable supercurators and superior antipathogens. FAME extract obtained from Scenedesmus intermedius microalgae has antimicrobial properties against Gram-positive bacteria (Bacillus cereus, Sterptococcus mutans and Streptococcus aureus); on Gram-negative bacteria (P. aeruginosa and E. coli); and fungi (Candida albicans and Aspergillus parasiticus).[18] The antimicrobial effectiveness of the *Cyanobacteria spirulina* extract is related to the secondary metabolite compounds contained therein, namely tannins, flavonoids, saponins and triterpenoids.[12] Tannin compounds as antimicrobials can occur by inactivating essential enzymes. After that, tannin molecules interact hydrophobically with proteins to form complexes. Hydrophobic bonds will cause denaturation and disrupt cell metabolism.[19] Flavonoid compounds can form complexes with proteins from bacteria through hydrogen bonds so that they can cause changes in the structure of cell walls and cytoplasmic membranes so that bacterial cells become lysed.[20] Protein denaturation is how saponins exert antimicrobial effects. Saponin is an antibacterial compound, because it can reduce the tension on the surface of the bacterial cell wall, so that the permeability of the bacterial membrane will be disrupted, the content of the active substance is similar to detergent. Bacterial life will be disrupted if the cell membrane is damaged. The stability of the cytoplasmic membrane will then be disturbed due to the diffusion of saponin across the membrane, causing cytoplasm leakage and cell death.[21] The antibacterial effect of triterpenoids is mediated by lipid damage to the cytoplasmic membrane, which disrupts the production of cell walls or membranes. As a result, the cell membrane or wall fails to develop or develops imperfectly.[22]

The antibacterial potential of algae extracts against *Streptococcus mutans* and Streptococcus aureus is higher than standard antibiotics. The antimicrobial activity of this microalgae is due to the presence of lipopolysaccharides, cyclic peptides and alkaloids.[23] Spirulina platensis can stimulate cellular antioxidant enzymes, reduce DNA damage, reduce lipid peroxidation and scavenge free radicals, and can also enhance the effects of superoxide catalase and dismutase.[24] Other studies that support the antimicrobial activity of Spirulina platensis extract at concentrations of 1, 10 and 100 mg/ml against gram-negative bacteria *Pseudomonas aureginosa (P. aureginosa)*, gram-positive bacteria *Streptococcus aureus* and pathogenic fungi.[25] The results of the inhibition percentage in 0.2% Chlorhexidine and a solution of *Cyanobacteria spirulina* with a concentration of 60 mg/ml showed a negative value, this indicates that there is no *Streptococcus mutans* antibiofilm power. The higher the concentration of Cyanobacteria spirulina solution, the higher the amount of active antibacterial compounds, this is evidenced by the large inhibitory power of Streptococcus mutans biofilm. The largest inhibition value of Streptococcus mutans biofilm was found in group P4, namely Cyanobacteria spirulina solution with a concentration of 90 mg/ml. There was a significant difference in *Streptococcus mutans* biofilm inhibition between groups P4 and group P2 and P3.

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CONCLUSION

Cyanobacteria spirulina solutions with concentrations of 70, 80 and 90 mg/ml had the ability to inhibit the formation of *Streptococcus mutans* biofilm. The highest value of *Streptococcus mutans* biofilm inhibition was found in *Cyanobacteria spirulina* solution with a concentration of 90 mg/ml.

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