

Comparison of the effects of hexetidine and chlorhexidine mouthwash on the plaque index

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Received 14 October 2022; 1st revision 14 November 2022; 2nd revision 16 Desember 2022; Accepted 23 Desember 2022; Published online 28 December 2022

Keywords:

Chlorhexidine;
effectiveness;
hexetidine;
Plaque index

ABSTRACT

Background: Plaque can cause damage to the tooth structure and supporting tissues, so it is necessary to take plaque control measures. The use of mouthwash such as hexetidine and chlorhexidine in chemical plaque control is effective in reducing plaque formation. Both of these mouthwashes were proven to have antibacterial activity against *Streptococcus mutans* which is one of the bacteria that causes plaque, so it is necessary to compare the effectiveness of the two ingredients to determine the difference in the effectiveness of the two types of mouthwash on the plaque index.

Methods: This research method is a pre-test post-test control group design. The plaque index examination was carried out before and after gargling. The subjects in this study consisted of 32 students of state junior high school (SMPN) 2 Cimahi aged 13-15 years. This research was conducted by examining the Silness and Loe plaque index. Chi-square was used to test the normality of the data and then analyzed by t-test.

Results: The results showed that there was a difference in the mean plaque index after rinsing with hexetidine and chlorhexidine of 0.077 and 0.167, respectively.

Conclusion: There was a significant difference in the comparison of plaque index after gargling using hexetidine and chlorhexidine mouthwash, where hexetidine showed more effective results as an antibacterial agent in reducing plaque in the oral cavity.

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doi: <http://dx.doi.org/10.30659/odj.9.2.327-333>

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Odonto : Dental Journal accredited as Sinta 2 Journal (<https://sinta.kemdikbud.go.id/journals/profile/3200>)

How to Cite: Novamaura *et al.* Comparison of the effects of hexetidine and chlorhexidine mouthwash on the plaque index.

Odonto: Dental Journal, v.9, n.2, p.327-333, December 2022

INTRODUCTION

Everyone certainly wants a healthy life and is free from various diseases. Health according to the World Health Organization (WHO) includes being physically, mentally, and socio-economically healthy. The behavior of maintaining dental and oral hygiene from an early age is very influential on dental and oral health in the future so the promotion of dental and oral health and also preventive measures must be taken as early as possible to prevent the emergence of dental and oral problems.¹

Dental plaque is a thin layer consisting of a collection of bacteria that covers the surface of the teeth. *Streptococcus mutans* which is one of the bacteria that causes plaque. The plaque index is a method used to measure the extent of plaque on the tooth surface.^{2,3} One of the prevention of plaque formation can be controlled by using mouthwash. The use of hexetidine mouthwash is an alternative approach to the activity of microorganisms.⁴

Various types of mouthwash are currently circulating in the market, one of the recommended ingredients is chlorhexidine mouthwash. Chlorhexidine is the most effective of all therapeutic plaque control agents because it can ionically adhere to teeth and oral mucosal surfaces in high concentrations for hours.⁵ However, in the market, there are also other mouthwashes that have broad-spectrum antibacterial effects besides chlorhexidine, namely hexetidine. Therefore, the purpose of this study was to compare the antibacterial effects of the two types of mouthwash namely hexetidine and chlorhexidine by examined the plaque index using the Silness and Loe method, so that there are other mouthwash alternatives that can be used besides chlorhexidine.

METHODS

Research design

The design of this study was a pre-post test control design group. This study aims to compare the plaque index compares before and after the use of hexetidine and chlorhexidine mouthwash in children aged 13-15 years.

Researchers examined the plaque index using the Silness and Loe method. The calculation method is to determine the Silness and Loe plaque index, using the formula below:⁶

$$\text{Plaque score} = \frac{\text{Total score of all tooth surfaces}}{\text{Total tooth surface}}$$

The assessment of the plaque score index on the entire surface of the index teeth using disclosing solution was carried out before and after the mouthwash treatment. Interpretation of index results was categorized: 0=good, 1.0-1.9=moderate, 2.0-3.0=bad.⁶

Plaque index scores were recorded before the participant rinsed his mouth using mouthwash. In each group, the research subjects were instructed to rinse their mouth using 15 ml of mouthwash and gargle for 30 seconds. The researcher gave instructions on using mouthwash as a substitute for brushing teeth in the morning and evening. Plaque index measurements were carried out the next day after 24 hours of using mouthwash.

The inclusion criteria in this study were being willing to participate in the study by filling out informed consent, having the Silness and Loe index teeth in good health, having moderate plaque values based on the results of the Silness and Loe plaque index measurement, being willing to follow the research procedure. Meanwhile, the exclusion criteria included: having physical and mental disabilities, wearing orthodontic appliances and dentures, taking antibiotics, or using mouthwash. The dropout criteria are participants are not present during the second examination, participants do not

use mouthwash at night or in the morning, and participants brush their teeth.

Research Subjects

The subjects of this study were children aged 13-15 years at state junior high school (SMPN) 2 Cimahi.

Number of Samples and Sampling Techniques

The number of samples in this study was determined using the following formula:⁷

$$(n-1) (t-1) \geq 15$$

$$(n-1) (2-1) \geq 15$$

$$n-1 \geq 15$$

Information:

n = number of samples

t = number of treatments

Based on these calculations, a sample of 16 people was obtained in each group, so the total sample in this study was 32 people.

Research Ethical Aspects

This research has obtained ethical approval from the Unjani ethics commission with no: 026/UMI.05/2021

The researcher visited state junior high school (SMPN) 2 Cimahi and gave a cover letter of ethics as follows: (1) Information to participants. The researcher gave an explanation to the state junior high school (SMPN) 2 Cimahi and the student's parents about the research activities, the aims and objectives of the research, as well as the research procedures to be conducted on children aged 13-15 years. (2) An informed consent form is given by the researcher to state junior high school (SMPN) 2 Cimahi to be signed by the parents or guardians of children aged 13-15 years, if they are not willing to be investigated, the researchers must respect their rights. (3) The research does not include the subject's name on the data collection

sheet, but a code to maintain confidentiality. (4) The researcher guarantees the confidentiality of any data obtained.

RESULTS

Subject characteristics based on the use of hexetidine and chlorhexidine mouthwash consisted of gender and age.

The characteristics of these subjects will be presented in Figure 1.

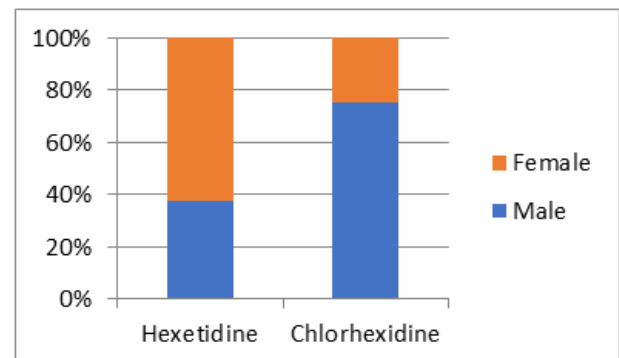


Figure 1. Characteristics of Subjects Based on Gender

Figure 1 shows that the number of participants who took part in the study was more male than female. Based on student data, state junior high school (SMPN) 2 Cimahi consists of 1293 students, with 648 male students and 645 female students.

Plaque Index Before and After Gargling Using Hexetidine Mouthwash

Plaque index before and after rinsing using hexetidine mouthwash were examined using the Silness and Loe plaque index examination method, which are presented in Tables 1 and 2.

Table 1. Statistical Descriptive Plaque Index Before and After Gargling Using Hexetidine Mouthwash

	n	Mean	Standard Deviation	Min.	Max.	p-value
Before	16	1.282	0.173	1.100	1.700	0.031
After	16	1.205	0.133	1.000	1.400	

The data in table 1 shows that there was a decrease in the average plaque index value from

1.282 to 1.205 with a p-value of 0.031. Statistical test results obtained p value = 0.031, it can be concluded that there is a statistically significant difference in plaque index after rinsing using hexetidine mouthwash because the p-value is smaller than 0.05 ($0.031 < 0.05$)

Table 2. Description of Plaque Index Before and After Gargling Using Hexetidine Mouthwash

Criteria	Before				After			
	n	Mean	Std. Dev.	%	n	Mean	Std. Dev.	%
Moderate	16	1.304	0.156	100	16	1.137	0.137	100

The data in Table 2 shows that the initial plaque index criteria for all participants were in the moderate category because of the homogenization carried out so that the participants who were included in the study selected participants with a moderate plaque index category, whereas after using hexetidine mouthwash, there was a decrease in plaque index.

From the results of research conducted and supported by previous studies, it was proven that the act of gargling using 0.2% hexetidine was able to significantly reduce the average plaque index value. This shows that 0.2% hexetidine mouthwash is effective in reducing plaque index in students of state junior high school (SMPN) 2 Cimahi aged 13-15 years.

Plaque Index Before and After Gargling Using Chlorhexidine Mouthwash

Plaque index before and after gargling using chlorhexidine mouthwash examined using the Silness and Loe plaque index examination method will be presented in Tables 3 and 4.

Table 3 Statistical Descriptive Plaque Index Before and After Gargling Using Chlorhexidine Mouthwash

	n	Mean	Standard Deviation	Min.	Max.	p-value
Before	16	1.304	0.156	1.100	1.600	0.001
After	16	1.137	0.137	1.000	1.400	

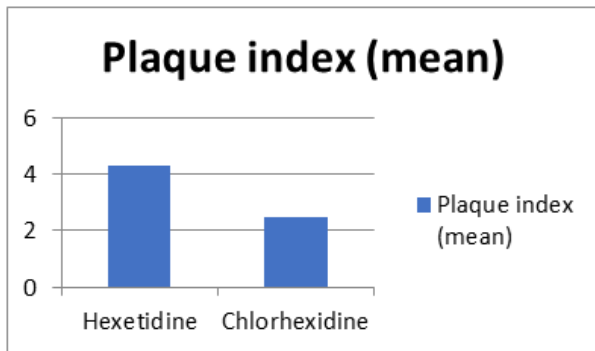
The data in table 3 shows that there was a decrease in the average plaque index value from 1.304 to 1.137 with a p-value of 0.001. The results of statistical tests showed that there was a statistically significant difference in plaque index after rinsing using a chlorhexidine mouthwash because the p-value = 0.001 (less than 0.05).

Table 4. Description of Plaque Index Before and After Gargling Using Chlorhexidine Mouthwash

Criteria	Before				After			
	n	Mean	Std. Dev.	%	n	Mean	Std. Dev.	%
Moderate	16	1,282	0,173	100	16	1,205	0,133	100

The data in table 4 shows that the initial plaque index criteria for all participants were in the moderate category because of the homogenization carried out so that the participants who were included in the study selected participants with moderate plaque index categories, but after the use of chlorhexidine mouthwash, there was a decrease in plaque in participants.

The results of this study showed that gargling using 0.12% chlorhexidine mouthwash was able to significantly reduce the average plaque index value. This shows that 0.12% chlorhexidine mouthwash is effective in reducing plaque index in students of state junior high school (SMPN) 2 Cimahi aged 13-15 years.



Standard Deviation= 0.124

p-value= 0.045

Figure2. Comparison of Plaque Index Before and After Gargling Using Hexetidine and Chlorhexidine Mouthwash

The data in Figure 2 shows that the difference in the mean value of plaque index after using hexetidine mouthwash is 0.077 while the difference in the mean value of plaque index after using chlorhexidine mouthwash is 0.167. Statistical test results obtained *p* value = 0.045, it can be concluded that there is a statistically significant difference in plaque index after rinsing using hexetidine and chlorhexidine mouthwash because the *p*-value is smaller than 0.05 ($0.045 < 0.05$).

DISCUSSION

This research was conducted at the students' homes at the state junior high school 2 Cimahi children in December 2020-January 2021 due to the uncontrolled Covid-19 pandemic conditions. The purpose of this study was to compare the effectiveness of hexetidine and chlorhexidine mouthwash on plaque index. The data in Figure 1 shows that the number of participants who took part in the study was more male than female so that the number of participants was 32 subjects with 16 subjects in each group. A total of 32 subjects involved in the study were divided into 2 groups, namely the group gargling with hexetidine mouthwash and the group gargling with chlorhexidine mouthwash with each group

consisting of 16 students and carried out according to health protocols.

Adolescence is the period at the end of childhood and the beginning of adulthood. Adolescence is a period of transition from child to adult or puberty, various critical things in growth and development will be experienced by a teenager towards maturity so it requires the formation of attitudes, values, interests, and mental adjustments. Adolescents often experience health problems, especially in the process of growth and development, one of which is dental and oral hygiene problems. The World Health Organization (WHO) has determined that schools and adolescents are important target groups for the examination and promotion of oral health and recommends the age for oral health examinations, namely the age of 12-14 years. For this reason, the age group chosen in this study was 13-15 years.⁸⁻¹⁰

Hexetidine is one type of antiseptic agent and has antiviral and antibacterial properties, so it can reduce and prevent the growth of plaque on the teeth. The use of hexetidine antimicrobials is an alternative approach to maintaining oral health. The mechanism of action of hexetidine affects pellicle formation in various ways. Hexetidine has broad-spectrum antibacterial properties against gram-positive bacteria. These things support and are in line with the research results in Table 1.^{11,12} One of the mechanisms of action of hexetidine includes influencing the formation of pellicles by blocking the acidic component of salivary glycoproteins, affecting the attachment of plaque to the tooth surface through binding to bacteria.⁸

The data in Table 2 shows that the initial plaque index criteria for all participants were in the moderate category because of the homogenization carried out so that the participants who were included in the study selected participants with a moderate plaque index category, whereas after

using hexetidine mouthwash, there was a decrease in plaque index. The mechanism of action of hexetidine is through disruption of cell membrane transport and bacterial metabolism, resulting in cell wall lysis. One of the mechanisms of action of hexetidine includes influencing the formation of out with chlorhexidine. Chlorhexidine is a mouthwash that can work quickly, has low toxicity, and has been proven effective against oral bacteria because it can reduce plaque microorganisms by 80% and can prevent plaque because it has bactericidal and bacteriostatic abilities against oral bacteria.¹²⁻¹⁴

Chlorhexidine, a cationic bisbiguanide with a very broad antimicrobial spectrum, is considered the gold standard antimicrobial agent for assessing the effectiveness of other antimicrobials, antiplaques, and herbal extracts. Chlorhexidine is considered one of the best antimicrobial agents in controlling dental biofilm formation. However, the molecular mechanism of the effect of chlorhexidine on *S. mutans* remains largely unknown.^{12,14-16}

Chlorhexidine is a cationic positively charged and will be attracted to the bacterial cell wall with a strong attachment and change the integrity of the bacterial cell membrane with chlorhexidine attracted to the cell membrane. Free chlorhexidine molecules enter cells and cause coagulation of proteins which causes a decrease in cell activity, which will result in cell death.^{12,14-20}

Based on previous research that has been done, it is known that hexetidine and chlorhexidine have the same effect in inhibiting plaque accumulation and also as antimicrobials. However, each of these mouthwashes has advantages and disadvantages, so their use depends on the needs. Researches using hexetidine mouthwash are still very rarely done, even though this hexetidine has advantages when compared to chlorhexidine, namely minimal side effects. Until now, there have

pellicles by blocking the acidic component of salivary glycoproteins, affecting the attachment of plaque to the tooth surface through binding to bacteria.^{5,9,11}

The results in Tables 3 and 4 were carried been no reports stating the side effects due to the use of hexetidine such as discoloration, hypersensitivity reactions of the oral mucosa, changes in the sense of taste, and the erosive effect of its metabolites on tooth enamel.^{11,12,17-24} The use of antibacterial mouthwash is certainly not recommended for long-term use in daily life as a substitute for brushing teeth. This is because of the many side effects that can occur.^{22,24}

CONCLUSION

There was a significant difference in the comparison of plaque index before and after rinsing using hexetidine and chlorhexidine mouthwash, where hexetidine showed more effective results as an antibacterial agent in reducing plaque in the oral cavity.

ACKNOWLEDGMENTS

We would like to thank FKG Unjani and state junior high school (SMPN) 2 Cimahi who have assisted in the research process.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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