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Comparison of effectiveness disinfection of glutaraldehyde 2% and hydrogen peroxide 3% on tooth extraction instruments in Department of Oral Surgery and Maxillofacial, Faculty of Dentistry, University Sumatera Utara

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Abstract

Objective: To compare disinfecting effectiveness of Glutaraldehyde 2% and Hydrogen Peroxide 3% on tooth extraction instruments at the Department of Oral Surgery, Faculty of Dentistry, Universitas Sumatera Utara.

Material and Methods: This was an experimental study with post-test only control group design approach. Purposive technique is applied to collect samples which are lower molar extraction forceps. In this study, sample were divided into 2 groups and each consisting of 18instruments soaked in Glutaraldehyde 2% and Hydrogen Peroxide 3%. Each instrumentwere pre-cleaned using brush, water and soap for both group before going through disinfection process.

Results: Statistically analyzed using Mann-Whitney Test. The comparison between Glutaraldehyde 2% and Hydrogen Peroxide 3%showedno significant difference to the total bacteria count on instrument after disinfection ($p=0.014 < 0.05$).

Conclusion: Glutaraldehyde 2% showed more effective than Hydrogen Peroxide 3% in disinfecting lower molar extraction forceps.

Keyword: Disinfection, Forceps, Glutaraldehyde, Hydrogen peroxide

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Introduction

Cross infection can occur with direct contact of human with microorganism, infection through droplets, inhalation of pathogens, and indirect contact with objects, through surgical instruments contaminated with blood, saliva, or other liquid containing microorganism during or after treatment or extraction.[1] Microorganism involved in the transmission of a disease are bacteria, viruses, fungi, or protozoa which is invisible for its micro size.[2]

Dental treatment often causes bleeding and exposure to blood, saliva and aerosol which are the keys to the spreading of diseases. Some examples of infectious diseases that often occur are HIV and HBsAg infections that can be occurred after inadequate sterilization of dental care. These infectious agents can be transmitted through saliva and blood. In 2010 at Saudi Arabia, 8.3% of cases were infected with HbsAg, while HIV reported at 4.019 cases. With these people infected with the hepatitis B and HIV virus, cross-infection became a concern for dental health workers and patients.[3]

As an effort to prevent cross infection of patients, dentist and staff, an action is needed in the form of environmental and instruments infection control. A good infection control is the duty of all officers in the dental clinic team. Other precautions that can be done are hand washing, uses of disposable equipments, disinfection and sterilization.[4]

Disinfection can be done by soaking using glutaraldehyde and hydrogen peroxide to kill bacteria on surgical instruments used in dental care.[5,6] In a study conducted by Ganavadiya et al.[6] using 6% hydrogen peroxide, 2% glutaraldehyde and 99% alcohol by soaking, hydrogen peroxide hadbeen the best effectiveness followed by glutaraldehyde 2% on bacteria.

From the research conducted by Pawashe et al.[7] using several disinfectant ingredients, 2% glutaraldehyde was a good disinfection material in reducing colony forming units of bacteria after 1% sodium hypochlorite.[7] Indonesian researchers, Setiawan et al.[8] comparing hydrogen peroxide with fenton. The results showed that hydrogen peroxide

had 6 times better onsafety and effectiveness than fenton.[8]

As from the background described, researchers are interested in examining the difference influence of soaking tooth extraction instruments in glutaraldehyde 2% and hydrogen peroxide 3% on total oral bacterial colonization on clinical students at the Department of Oral Surgery and Maxilofacial in the periods of March to May 2018

Material and Methods

This study is an experimental with post-only control group design approach. Sampling method used in this study is purposive sampling and used lower molar extraction forceps in Department of Oral Surgery and Maxillofacial, Faculty of Dentistry, University Sumatera Utara as samples. In this study, samples are divided into two groups consisting of 18 extraction instruments which are lower molar forceps soaked in glutaraldehyde 2% solution and hydrogen peroxide 3% solution,

Lower molar extraction forceps were first cleaned with brush, water and soap to eliminate visible blood and saliva on the forceps. Then, the forceps was immersed into a container that contains 250ml of disinfectant solution for 30 minutes for both groups. After that, forceps wereremoved from disinfectant, rinsed with sterile aquadest and dried with sterile gauze, then the beak of forceps was immersed in 50ml of saline for 5 minutes and the container was closed tightly and sent to the microbiology laboratory for bacterial cultivation and colony bacteria count.

The samples solution was diluted until 10^{-3} and cultivated on plate count agar and were incubated for 24 hours. The number of bacterial colonies formed on the plate count agar then counted by using bacteria colony counter. From the bacteria colonized on plate count agar 1 use was taken to make pure culture of the colony on nutrient agar and incubated for 24 hours. Pure culture was used to observe gram type of the bacteria. Data processing was done with computerized analysis using Mann-Whitney test.

Table 1 **Total plate count after disinfection**

	Total Plate Count (10^3 CFU/ml)	
No	**Glutaraldehyde 2%**	**Hydrogen Peroxide 3%**
1	0	0
2	0	0
3	0	0
4	0	0
5	0	0
6	0	0
7	0	0
8	0	112
9	0	3
10	0	0
11	0	0
12	0	0
13	8	0
14	0	0
15	0	0
16	0	6
17	0	0
18	0	0

Results

This study showed that out of 36 lower molar extraction forceps, 18 were disinfected using glutaraldehyde 2% and 18 were disinfected with hydrogen peroxide 3%. Out of 18 forceps disinfected using glutaraldehyde 2%, 1(5.56%) is still contaminated showed by bacterial colonies formed on the plate count agar which is 8.10^3 CFU/ml. Out of 18 forceps disinfected using hydrogen peroxide 3% showed that 3 (16.67%) are still contaminated with the maximum score of 112.10^3 CFU/ml table 1. The mean results of each group obtained are 444.44±1.885.62 CFU/ml for glutaraldehyde 2% group and 6722.222±6318.87 CFU/ml for hydrogen peroxide 3% table 2. Shapiro-Wilk test was conducted to determine the normality of data and the result was not distributed normally, so Mann-Whitney test is used in this study table 3.

The Mann-Whitney test was conducted to determine whether there were significant differences between disinfecting lower molar extraction forceps using glutaraldehyde 2% and hydrogen peroxide 3%. The result of Mann-Whitney test between the treatment group and control group arep-value=0.000<0.05 table 3. This result showed that there was no significant differences in the number of bacterial colonies between the glutaraldehyde and hydrogen peroxide post disinfection. Beside the number of bacterial colonies, this study also observed the gram type of bacteria remains in the sample and as the result all of them are gram negative bacteria.

Discussion

The disinfectants tested in this study were glutaraldehyde 2% and hydrogen peroxide 3%. Glutaraldehyde has been used widely as

Table 2 Mean result of total plate count of two groups

Group	Sample	Mean (CFU/ml)	Standard deviation (CFU/ml)
Glutaraldehyde 2%	18	444.44	1885.62
Hydrogen Peroxide 3%	18	6722.22	26318.87

Table 3 Normality test and statistical test of two groups

Group	Mean ± Standard Deviation (CFU/ml)	P-value (Shapiro-Wilk)	P-value (Mann Whitney)
Glutaraldehyde 2%	444.44 ± 1.885.62	0.000	0.310
Hydrogen Peroxide 3%	6722.22 ± 26318.87	0.000	

high-level disinfectant for over 30 years because of its favorable materials compatibility, cheaper cost, andits immersion time is longer. Hydrogen peroxide is also widely used in the household and in medical field as antiseptic, bleaching or oxidator material and disinfectant as well as surface / environmental cleaning.[6,9] The spaulding classification describes three instruments/risk categories (critical, semi-critical and non-critical), each of which has specific reprocessing requirements. According to the Spaulding classification, lower molar extraction forceps are classified as critical items, objects that enter sterile tissue or vascular system should be sterile because any microbial contamination could result in disease transmission.[10,11]

The result from the 13th glutaraldehyde sample group was 8.10^3 CFU/ml, where this is the only sample that still contaminated after disinfection with glutaraldehyde. This may be caused by some factors, one of them are the patient oral hygiene status and pathological findings such as severe caries, periodontal diseases, pulp necrosis or abscess during tooth extraction. Recent studies showed streptococcus mutans is frequently isolated from caries lesions, non-mutans streptococcus, actinomyces, lactobacillus and bifidobacterium were from dental biofilms covering whit-spot lesions. Acute abscess frequently caused by caries, trauma and failed root canal treatment. In dental abscess culture, polymicrobialswere often found including streptococcus viridans, prevotella sp and fusobacterium sp. Recent study showed bacteroides and porphyromonas sp were found on the abscess culture as well. Treponema sp is an obligate anaerobe, helix shaped and often related to periodontal diseases, as well as found in dental acute abscess. Besides that, environmental sterility during the sampling procedures and bacterial cultivation procedure in laboratory and operator negligence can be resulted in increases number of bacteria colonies cultivated.

Hydrogen peroxide group showed lower disinfection effectiveness than the glutaraldehyde group. There are 3 samples in which were still contaminated after the disinfection such as 8th, 9th, and 16th and number of bacterial colonies are mostly higher in this group, at the maximum of 112.10^3 CFU/ml. It might cause by the same factors as glutaraldehyde which are patient's oral hygiene and pathological findings.

In this study, observation of the gram type bacteria was done to see whether it is gram positive or gram negative. After the observation of 4 contaminated samples, all of them were stained red which is a gram-negative bacteria.

Conclusion

According to the results presented above, it can be concluded that glutaraldehyde 2% is more effective on disinfecting lower molar extraction forceps than hydrogen peroxide 3% with very small difference, therefore glutaraldehyde 2% ismore recommended to be used for disinfecting lower molar extraction forceps since glutaraldehyde usage is more safe compare to hydrogen peroxide in instrument corossion.

Acknowledgment

None.

Conflict of Interest

The authors report no conflict of interest.

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