Volume 1, issue 1, 2024: 123-126

"Research Article"

The Effect of Imbibition on Immersion Hydrocolloid Irreversible Alginate Sodium Hypochlorite Disinfectant Solution and Red Betel Leaf (Pipper Crocatum) Extract

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Abstract

Background: impressing the patient's oral cavity in dentistry can pose a risk of cross infection between doctor and patient. Therefore it is necessary to disinfect the impression material to remove bacteria that stick to the impression material. Disinfection that can be used besides sodium hypochlorite can also extract red betel leaves. **Purpose**: to find out the difference of imbibition on immersion hydrocolloid irreversible alginate in sodium hypochlorite 1% and red betel leaf extract 100%. **Method**: this research is experimental with pretest and posttest control group design with 4 treatment groups, 2 groups were immersed in sodium hypochlorite 1% and 2 groups were immersed in red betel leaf extract 100%. Immersing time is 5 and 10 minutes. Each repetition is done 6 times. Negative molds are measured before and after immersion. Data were analyzed using the OneWay Anova Test. **Results:** The effects of alginate mold imbibition on sodium hypochlorite immersion were greater than immersion in red betel leaf extract. **Conclusion:** There was a significant difference (p < 0.05) in the imbibition of the printed hydrocolloid irreversible alginate soaked in sodium hypochlorite 1% and red betel leaf extract 100% for 5 minutes, and 10 minutes.

Keywords: dimensional stability, imbibition, sodium hypochlorite, red betel leaf extract, alginate

INTRODUCTION

Alginate impression material (irreversible hydrocolloid) is an impression material that is often used in dentistry. Alginate impression materials are usually used to make impressions such as partial dentures, initial impressions of complete dentures, orthodontics, and study models.¹ The advantages of using alginate impression material are that it is easy to manipulate, comfortable for the patient, and cheap because there is no need to use a lot of complicated equipment.².

Alginate impression materials also have dimensional changes that can change the size of the alginate mold, causing the aginate mold to be inaccurate. Changes in the dimensions of the alginate mold, namely syneresis and imbibition ³. An alginate mold in which it loses its water content through evaporation is called syneresis, while an alginate mold that is placed in water will absorb the water, which is called imbibition ². However, before casting the cast, the alginate mold must be disinfected first because it can be a medium for spreading viruses such as hepatitis B, HIV and herpes simplex. This virus can pose a risk to dentists and laboratory personnel ⁴. An alginate mold is disinfected for a maximum of 10 minutes or can be sprayed with an antimicrobial agent without making significant changes in dimensions ².

The American Dental Association (ADA) recommends that disinfectants be chlorhexidine, used, namely sodium hypochlorite, glutaraldehyde, and iodine agents. Sodium hypochlorite is the disinfection solution of choice for alginate impression materials. The Environmental Protection Agency (EPA) states that the sodium hypochlorite disinfectant solution does not irritate the skin, can inhibit bacteria on a broad spectrum, without damaging the alginate surface. But there is a drawback in the form of a strong odor 5 .

There are other disinfectants made from natural ingredients that can be

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used to disinfect alginate molds. One of them is red betel leaf because it contains antibacterial compounds. The compounds contained in red betel leaves are flavonoids, alkaloids, polyphenolic compounds, tannins and essential oils ⁶. According to the fungistatic test, betel leaf extract with low concentrations such as 20%, 40% and 60% cannot inhibit the growth of cell mass. Meanwhile, extracting betel leaves at high concentrations such as 80% and 100% can inhibit the growth of candida albicans cell mass ⁷.

This research generally aims to determine the differences in dimensional stability in alginate molds that are soaked in 1% sodium hypochlorite and 100% red betel leaf extract.

MATERIAL AND METHODE

The method used in this research was experimental with a pre and post test with control design using simple random sampling with 4 treatments. The materials used in this research were alginate impression material. 1% sodium hypochlorite, 100% red betel leaf extract, distilled water, and 70% ethanol. The tools used are spatula, rubber bowl, round master cast (18x28)mm), sliding caliper. stopwatch, analytical balance, maceration vessel. rotary vacuum evaporator. viscometer. The research began with determining the experimental group, then continued with providing the intervention. The minimum number of repetitions is 6 times.

Red betel leaves are picked and washed, then dried in the oven, cut into small pieces and blended. Then, to make it smooth, the dried simplicia is sifted. To make a thick extract, maceration is carried out by dissolving dried simplicia in 70% ethanol. Leave for 24 hours and stir occasionally. The filtrate was taken by filtering using flannel cloth and followed by filter paper. The filtrate that has been filtered in the rotary vacuum evaporator. The extract was mixed with distilled water, after which the extract with a concentration of 100% was tested using a Brookfield viscometer. The next step for diluting 1% sodium hypochlorite is by diluting 12% sodium hypochlorite to 41.67 ml, adding 458.33 ml of water.

Making alginate molds begins by weighing the alginate according to factory regulations (16gr/38ml), mixing the alginate and distilled water in a rubber bowl. The mixed alginate is poured into the round master cast. After setting, the alginate mass is weighed on an analytical balance, then soaked in a disinfectant solution. After 5 or 10 minutes the alginate is taken and weighed again for measurement after immersion. Data analysis was carried out using the One way Anova test.

RESULT

Results of research on the dimensional stability of alginate molds after immersion in 1% sodium hypochlorite. Table 1, Results of the average difference before and after soaking in alginate for 5 minutes

| | Sodium hipoklorit 1% | Ektrak daun sirih merah 100% |
|-------------|----------------------------|---------------------------------|
| Rata- rata | 0,085 | (-) 0,1833 |
| Sts.Deviasi | 0,02074 | 0,16537 |

Table 2, Results of the average difference before and after soaking in alginate for 10 minutes

| arter souking in arginate for to initiates | | | | | | | | |
|--|-------------|------------|--------------|--|--|--|--|--|
| | | Sodium | Ekstrak daun | | | | | |
| | | hipoklorit | sirih merah | | | | | |
| | | 1% | 100% | | | | | |
| | Rata-rata | 0,0983 | (-) 0,2233 | | | | | |
| | Std.Deviasi | 0,04579 | 0,06055 | | | | | |
| | | | | | | | | |

(-) Is defined as a decrease in alginate mass

Table 1 shows the average difference in alginate soaking in 1% sodium hypochlorite for 5 minutes, namely 0.085. The group soaked in 100% red betel leaf extract for 5 minutes 0.1833. In table 2, the average difference between alginate and 1% sodium hypochlorite soaking for 10 minutes is 0.0983.

Table 3, One Way Anova test

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| | Sum | | | | |
|---------|------|----|--------|--------|-------|
| | of | | | | |
| | Squa | | Mean | | |
| | res | df | Square | F | Sig. |
| Between | ,527 | 3 | ,176 | 20,969 | ,000, |
| Groups | | | | | |
| Within | ,168 | 20 | ,008 | | |
| Groups | | | | | |
| Total | ,695 | 23 | | | |

The results of the Oneway Anova test from the four groups showed a p value = 0.000 (0 < 0.05) which means there was a significant difference in the mass difference of alginate soaked in 1% sodium hypochlorite solution and 100% red betel leaf extract for 5 and 10 minutes.

DISCUSSION

The result of a mold is said to be good if it is accurate and has the right dimensional stability until the plaster is poured. Accuracy in alginate molds is influenced by several factors, including errors when making the mold, errors when moving the mold, and the presence of imbibition and syneresis ⁸.

In this study, an alginate mold soaked in 1% sodium hypochlorite for 5 minutes and 10 minutes had a mass increase of ± 0.085 and ± 0.0983 , respectively. The time difference in immersion does not have a significant difference because the time interval is not long. However, dimensional changes still occur due to the fiber-shaped structure of alginate which makes it easier to absorb water. This is the same as research by Hidayat, et al (2019) that alginate disinfection with a time of 5, 10, and 15 minutes still occurs in dimensional changes even though these changes are not significant⁴. Soaking the alginate in 100% red betel leaf extract for 5 minutes and 10 minutes respectively had ±0.1833 and ± 0.2233 . Just like 1% sodium hypochlorite solution, the soaking time does not have a significant difference although there are still changes, but only slightly. The red betel leaf extract experienced dimensional

changes in the form of a decrease in alginate mass.

The difference in the type of solution between 1% sodium hypochlorite and 100% betel leaf extract has significant or significant differences. This is because the properties and contents of the two solutions are different. Hiraguchi, et al (2012) stated that when an alginate mold is placed in a sodium hypochlorite solution, the mold will absorb water. The water transfer is caused by the different osmotic pressure between the alginate mold and the sodium hypochlorite solution.

The 100% red betel leaf extract did not experience dimensional changes in the form of imbibition due to a decrease in the mass of the alginate mold. According to Novitasari et al (2013), red betel leaves contain kavikol as a disinfectant which does not affect the calcium alginate bonds, so kavikol has no effect on the dimensions of the alginate⁹. In the red betel leaf extract there are also exudates or foreign objects such as stuck extracts in the solution, causing the imbibition process to be hampered. Another thing that can affect the alginate mold is because in this study the alginate mold was left in the open air for 1 minute to drain after soaking and also when the mass was weighed¹⁰. Therefore, the alginate mold experiences evaporation. Changes in dimensions are also caused by many random things in this research such as the type of material, method of taking the mold, thickness of the printing material, model material used, room temperature ¹¹.

CONCLUSION

After conducting the research, it can be concluded that there is a significant difference (p<0.05) in the imbibition of hydrocolloid irreversible alginate impression material soaked in 1% sodium hypochlorite solution and 100% red betel leaf extract for 5 minutes and 10 minutes. The difference in soaking time between 5 and 10 minutes did not show significant differences in results.

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ACKNOWLEDGMENT

Researcher would like to thank Rifa Rihadatul Hanifah for her assistance in providing this research could be carried out. Lastly researcher would like to acknowledge the support received from Faculty of Dentistry Muhammadiyah University for providing the necessary resources and encouragement that enabled this collaborative effort.

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