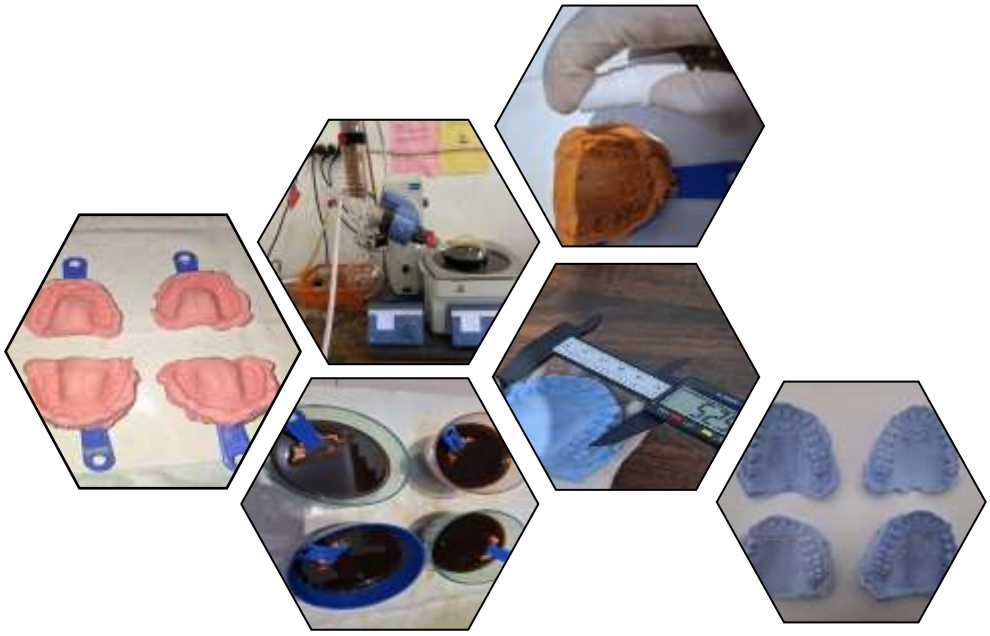
EFFECT OF SPRAYING AND SOAKING DISINFECTION TECHNIQUES USING 50% GREEN TEA (CAMELLIA SINENSIS) LEAF EXTRACT ON DIMENSIONAL STABILITY OF ALGINATE IMPRESSION MATERIALS



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DENTAL EDUCATION

FACULTY OF DENTISTRY

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MAKASSAR

2024

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Thesis

As one of the requirement to achieve a bachelor's degree of Dentistry program

Dental Education

DENTAL EDUCATION
DEPARTMENT OF MATERIAL SCIENCES AND DENTAL TECHNOLOGY
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HASANUDDIN UNIVERSITY
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THESIS

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Has been defended before the undergraduate Dental Education Examination Committee and declared to have fulfilled the graduation requirements on

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ABSTRAK

PENGARUH TEKNIK DESINFEKSI SECARA PENYEMPROTAN DAN PERENDAMAN MENGGUNAKAN EKSTRAK DAUN TEH HIJAU (*CAMELLIA SINENSIS*) 50% TERHADAP STABILITAS DIMENSI BAHAN CETAK ALGINAT

Nanda Mulia Nurhimsa, Lenni Indriani Hatta

Latar Belakang: Cetakan gigi harus didesinfeksi untuk mencegah kontaminasi silang, terutama dalam situasi penyakit menular seperti COVID-19. Untuk tujuan ini, American Dental Association (ADA) merekomendasikan desinfeksi cetakan gigi dengan cara membilasnya menggunakan air, lalu merendamnya dalam larutan desinfektan seperti natrium hipoklorit 0,5% selama waktu standar 10 menit. Meskipun desinfektan kimia seperti natrium hipoklorit efektif, penggunaannya dapat menimbulkan efek samping. Sebagai alternatif alami, ekstrak daun teh hijau (*Camellia sinensis*), yang dikenal memiliki sifat antimikroba dan antioksidan, menawarkan pilihan yang lebih aman dan ramah lingkungan tanpa mengurangi akurasi cetakan. **Tujuan Penelitian:** Untuk mengkaji dampak teknik desinfeksi penyemprotan dan perendaman dengan ekstrak daun teh hijau *(Camellia sinensis)* 50% terhadap stabilitas dimensi alginat. **Metode Penelitian:** Penelitian eksperimental laboratorium dengan sampel penelitian 28 cetakan alginat yang diberikan tiga perlakuan berbeda yaitu penyemprotan, perendaman dan tanpa perlakuan. Analisis data yang digunakan adalah Uji one way anova dan uji duncan. **Hasil Penelitian:** Kedua teknik desinfeksi efektif mencegah kontaminasi silang, tetapi penyemprotan menghasilkan perubahan dimensi yang lebih kecil dibandingkan perendaman, meskipun keduanya tetap dalam batas toleransi klinis menurut ADA No. 19. Ekstrak daun teh hijau dapat menjadi alternatif desinfektan alami yang efektif. **Kesimpulan:** Penggunaan ekstrak daun teh hijau *(Camellia sinensis)* 50% sebagai desinfektan memengaruhi stabilitas dimensi cetakan alginat. Teknik penyemprotan menghasilkan perubahan dimensi yang lebih kecil dibandingkan dengan perendaman, meskipun keduanya tetap dalam batas toleransi klinis.

Kata Kunci: Cetakan alginat, Desinfeksi, Stabilitas dimensi, Ekstrak daun teh hijau 50%

ABSTRACT

EFFECT OF SPRAYING AND SOAKING DISINFECTION TECHNIQUES USING 50% GREEN TEA (CAMELLIA SINENSIS) LEAF EXTRACT ON DIMENSIONAL STABILITY OF ALGINATE IMPRESSION MATERIALS

Nanda Mulia Nurhimsa, Lenni Indriani Hatta

Background: Dental moulds must be disinfected to prevent cross-contamination, especially in infectious disease situations such as COVID-19. For this purpose, the American Dental Association (ADA) recommends disinfecting dental moulds by rinsing them with water, and then immersing them in a disinfectant solution such as 0.5% sodium hypochlorite for a standard time of 10 minutes. Although chemical disinfectants such as sodium hypochlorite are effective, their use may cause side effects. As a natural alternative, green tea leaf extract (Camellia sinensis), which is known to have antimicrobial and antioxidant properties, offers a safer and eco-friendly option without compromising on mould accuracy. **Research Objective:** To assess the impact of spraying and soaking disinfection techniques with 50% green tea (Camellia sinensis) leaf extract on the dimensional stability of alginate. **Research Methods:** Laboratory experimental research with a research sample of 28 alginate moulds given three different treatments namely spraying, soaking and no treatment. The data analysis used was one way anova test and duncan test. **Research Results:** Both disinfection techniques were effective in preventing cross-contamination, but spraying resulted in smaller dimensional changes than soaking, although both remained within clinical tolerance limits according to ADA No. 19. Green tea leaf extract may be an effective alternative to natural disinfectants. **Conclusion:** Theuse of 50% green tea (Camellia sinensis) leaf extract as a disinfectant affects the dimensional stability of alginate moulds. The spraying technique resulted in smaller dimensional changes compared to immersion, although both remained within clinical tolerance limits. .

Keywords: Alginate Impression, Disinfection, Dimensional stability, 50% green tea leaf extract

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CHAPTER I
INTRODUCTION

1.1 Background

Dental impressions are an integral part of patient management from diagnosis to treatment and understanding their properties and manipulation is essential for the practicing dentist. Impression making is the first part of the process, which creates a negative shape of the tooth and tissue that can be processed with gypsum or other impression materials to create a functional analog. [1]

In general, there are two types of printing materials: elastic and non-elastic. Non-elastic impression materials have limited use in patients *progress* and without *undercut*. Meanwhile, elastic impression materials are the materials most widely used in dental technology. This is because this impression material is capable of printing hard and soft tissue in the oral cavity including *undercut* and interproximal gaps. One of the commonly used elastic printing materials is *hydrocolloid irreversible* or alginate.[2]

Alginate is referred to as *irreversible* because once formed in a semi-solid form, it cannot be changed back to its original form. This material is widely used in dentistry for making impressions, especially in partially edentulous subjects.[3] This impression material is known for its low cost, better patient tolerance, ease of handling, short execution time, very simple instrumentation and execution technique, and the possibility of detecting detailed impressions (even in the presence of cuts), all in one step . [4, 5]

Alginate impression material has imbibition properties, meaning it absorbs water when it comes into contact with water so that its shape expands more easily. This can cause changes in the shape or dimensions of the mold so that expansion can easily occur which can cause inaccuracies in the alginate mold. Therefore, the dimensional stability of the alginate impression is important in the success of making subsequent mold models. Besides that, alginate shrinks easily when left in the open air for too long. So it is important to maintain the humidity of the alginate mold so that its dimensional stability is well maintained. Therefore, the cast must be poured immediately.[6]

The oral cavity is the most important link between the human body and the external environment and is well equipped to protect the body from invading pathogens. There are more than 700 types of microorganisms that colonize the human oral cavity.[7]

In a study showing that the oral microbiome is a complex ecological system and interactions between its inhabitants and host cells influence human health and disease. [8,9] There is one condition that has just occurred, namely the COVID-19 pandemic which is caused by SARS-CoV-2 is mentioned by WHO as a pathogen that can be transmitted by asymptomatic, pre-symptomatic and symptomatic individuals through close contact through exposure to infected droplets and aerosols. Transmission can occur through activities involving the oral cavity, such as talking, breathing, coughing, sneezing and even singing. Although this condition is more

focused on respiratory infections, it should be noted that the oral cavity is one of those involved in the spread of COVID-19. [10]

To prevent cross-infection, the American Dental Association (ADA) recommends rinsing the impression material with water to remove saliva and blood that sticks to the impression material. In this case, it is recommended to soak it in a disinfectant solution to avoid bacterial contamination before sending it to the laboratory with a standard time of 10 minutes or by spraying technique using 0.5% sodium hypochlorite solution for 10 minutes. [11,12,13]

There are two types of materials that are often used for disinfection of printed materials, namely chemicals and natural materials. There are several types of chemical disinfectants on the market, namely sodium hypochlorite, iodophor (biocide), phenol, glutaraldehyde (sporicidin), glyoxal glutaraldehyde (impresept), and chlorhexidine. Natural ingredients that can be used as disinfectants and have been tested for their effectiveness against bacteria.[14]

Disinfectants used routinely (sodium hypochlorite, glutaraldehyde) can cause several adverse effects such as a burning sensation in the mouth and throat, irritation of the eyes and skin, watery eyes, etc. Therefore, this material is dangerous for health workers and the environment. Therefore, the need is to find more natural biocompatible alternatives with comparable disinfection efficacy. [15] Natural ingredients can be used as alternative disinfectants, because they are relatively cheaper, easy to process and easy to obtain. One natural ingredient that can be used as a disinfectant is green tea leaves (*Camellia sinensis*).

According to the manufacturing process, the tea plant itself is classified into 3 main categories: non-fermented (green and white tea), semi-fermented (oolong tea), and fermented (black and red tea), although all tea comes from the same plant. .[16]

In the non-fermented category, the difference between these two types of tea is that green tea leaves are obtained by drying fresh leaves, while white tea leaves are obtained by taking shoots from very young leaves, then steaming them and then drying them.[15] Then in the semi-fermented group, oolong tea is obtained by going through several procedures of collecting tea leaves at a certain time which is then followed by drying and withering, fermentation, panning, rolling, burning, final burning, and packaging.[16] For the fermentation category, black and red tea are obtained by fermentation first and then drying[15].

Green tea leaves are a plant that contains phenolic and non-phenolic substances. Apart from that, green tea also has anti-inflammatory, antioxidant and anti-carcinogenic effects. The use of green tea as a disinfectant in dentistry allows the use of solutions that are not only effective but also free from chemicals. The use of green tea is also considered to have many benefits compared to other types of tea because it does not undergo fermentation and has less oxidation.[17]

According to Jigisha et al, the use of tea leaf extract is considered to be anti-bacterial such as bacteria *Escherichia coli, Enterococcus faecalis, Salmonella typhi, Staphylococcus aureus* And *Pseudomonas sp.* Not only that, this tea leaf extract is also able to provide anti-fungal effects for fungi such as *Candida albicans* and antivirals such as HIV.[18]

In research conducted by Voina et al, it was stated that the use of 50% tea leaf extract was considered to show more important antimicrobial activity, especially in *Peptostreptococcus anaerobius.* Then on *mutating streptococcus* showed significant activity, but on *candida albicans* This itself has no anti-fungal effect.[19]

This is the basis for researchers to determine the effect of spraying and soaking disinfection techniques using green tea leaf extract (*Camellia sinensis*) 50% on the dimensional stability of alginate.

1.2 Problem Formulation

Based on the background that has been explained, the problem formulation can be taken, namely :

1. Does the disinfection technique of alginate moulds by immersion method using green tea leaf extract (Camellia sinensis) affect dimensional stability?
2. Does the alginate mould disinfection technique using the spraying method with green tea leaf extract (Camellia sinensis) affect dimensional stability?
3. Does a green tea (Camellia sinensis) leaf extract concentration of 50% affect the dimensional stability of alginate moulds?

1.3 Research Objectives

1.3.1 General objective

To assess the impact of spraying and soaking disinfection techniques with 50% green tea *(Camellia sinensis)* leaf extract on the dimensional stability of alginate.

1.3.2 Specific objectives

1. To measure the change in dimensional stability of alginate after applying the disinfection technique of spraying and soaking with 50% green tea leaf extract.
2. Comparing the effect of spraying disinfection technique with soaking technique on the dimensional stability of alginate.
3. Assessing whether 50% green tea *(Camellia sinensis)* leaf extract concentration affects the dimensional stability of alginate.

1.4 Research Benefits

This research is expected to add insight to writers and readers, and add to institutional references on the effect of alginate mould disinfection techniques with green tea leaf extract *(Camellia sinensis).*

CHAPTER II
RESEARCH METHODOLOGY

2.1 Types and Design of Research

2.1.1 Type of Research

The type of research used is laboratory experimental

2.1.2 Design of Research

1. According to the Scope of Research: Laboratory
2. By Time of Study: Longitudinal (*follow-up)*
3. By Substance : Applied
4. According to the Relationship Between Variables: Analytical
5. According to the Manipulation/Treatment: Experimental

2.2 Location and Time of Research

2.2.1 Research Location

The location of the research was carried out at Laboratory of Dental Materials Faculty of Dentistry, Hasanuddin University and Labortory of Chemistry Pharmacy Faculty of Pharmacy, Moslem University of Indonesia

2.2.2 Research Time

The research was conducted in March 2024

2.3 Research Variables

1. Independent variable: Spraying and soaking techniques using 50% green tea *(Camellia Sinensis)* leaf extract
2. Dependent variables: Dimension stabitlity of alginate

2.4 Variable Operational Definition

Green tea leaf extract (*Camellia Sinensis)*	Tea leaves (*Camellia Sinensis)* freshly obtained from the Malino tea garden through a drying to extraction process. Then obtained a solution of green tea leaves (*Camellia Sinensis)* with a concentration of 50%.
Alginate mold spraying	Spray using green tea leaf extract until it covers the entire surface of the alginate. In this study, measurements were taken 5, 10, and 15 minutes after spraying the prints.

Soaking the alginate mold	Soak the alginate mold using 50% tea leaf extract until the entire surface of the alginate is submerged in the solution and the treatment is carried out for 5, 15 and 30 minutes.
Dimensional stability	Dimensional stability of an alginate mold is the condition where the alginate mold model has a consistent size both before and after molding

2.5. Research Sample

The samples of this study were alginate moulds consisting of 28 samples divided into seven groups: one control group without soaking and spraying, three groups soaked in 50% tea leaf extract for 5, 15, and 30 minutes, and three groups sprayed using 50% tea leaf decoction for 5, 10, and 15 minutes. Each group consisted of 4 samples.

In this study, the minimum sample size was estimated based on Frederer's formula as follows:

(t - 1) (r - 1) ≥ 15

Description:

t = number of treatments

r = number of replicates

In this formula, t = 7 will be used because it uses 7 treatment groups, so the minimum number of samples (n) for each group is determined as follows:

(t - 1) (r - 1) ≥ 15

(7 - 1) (r - 1) ≥ 15

6r - 6 ≥ 15

r ≥ 3,5 ~ 4

2.6 Criteria Sample

Measurements were made after the gypsum experienced *setting time* to become solid and the printed results in the form of solid gypsum were measured using a digital caliper with an accuracy of 0.5 mm. Measurements are made at points that have been printed.

The results of the alginate mould are said to have stable dimensions if after soaking and spraying with 50% tea leaf extract on the alginate mould, then the results of the mould in the form of solid gypsum are measured using a digital caliper to produce the same size as the control group measurements.

2.7 Tools & Material of Research

2.7.1 Tools

1. Vernier caliper
2. Rubber bowl
3. Spatula
4. Measuring spoon
5. Stopwatch
6. Measuring cup
7. Filter cloth
8. Study Model
9. Impression tray

2.7.2 Materials

1. Normal alginate molding material set
2. Dental stone type III
3. Water
4. Green tea leaf extract 50%

2.8 Research Procedure

2.8.1 Alginate Sample Making

1. Alginate powder and water were measured with measuring spoons and measuring cups according to the manufacturer's instructions.
2. Pour alginate powder and water into the rubber bowl.
3. Then stir at a consistent speed and pressure, stirring is done with the figure of eight technique. Each group gets the same time treatment for 10 seconds.
4. Filling the tray with alginate that has been stirred
5. Next, print the master model made of blue gypsum, after setting the model is removed from the tray so that the resulting mold of alginate material
6. Then make 4 samples for 7 treatment groups according to the research sample that has been determined.

7. Especially in the control group, no disinfection technique was carried out so that the gypsum filling was immediately carried out on the alginate mold. After setting time, do the casting with type III cast.

2.8.2 Green Tea Leaves Extract Making

1. Select fresh green tea leaves, wash them thoroughly, and cut them into small pieces.
2. Air-dry the leaves for 3 days in a shady place without direct sunlight.
3. Blend the dried leaves using a blender to a coarse powder.
4. Soak the powder in 70% ethanol for 24 hours at room temperature (maceration process).
5. Filter the solution using filter paper, re-macerate the residue up to three times, then combine all filtrates.
6. Concentrate the filtrate using a rotary vacuum evaporator at 45-50°C to obtain a thick extract.
7. Dilute the extract to obtain 50% concentration using distilled water.

2.8.3 Disinfection Technique Procedure

The disinfection techniques carried out in this study are soaking and spraying disinfection techniques using 50% green tea leaf extract. The soaking technique is carried out on alginate molds by soaking using a disinfectant solution until all parts of the alginate surface are immersed in the solution, the disinfectant solution used is ± 300 ml, and the treatment is carried out for 5, 15, and 30 minutes.

Then, the spraying technique is carried out on the alginate mold by spraying using green tea leaf extract until it hits all parts of the alginate surface. The distance between the sprayer and the alginate is ± 5 cm and the solution used is ± 2 ml. take measurements 5, 10, and 15 minutes after spraying on the molded results, namely the master model.

2.8.4 Alginate Impression Filling

Filling the mold using type III gypsum with a powder to water ratio of 2:1 or equivalent to 100 grams of powder: 50 ml of water. How to make the filling material is done by putting water into the powder in the rubber bowl and stirring for 60 seconds, then filling it into the alginate printing material, after which vibration is carried out so that all parts of the alginate mold are evenly printed with gypsum. Wait for 10 minutes for the gypsum to experience final setting.

2.8.5 Dimensional Stability Measurement

Measurements were made after the gypsum experienced setting time to become solid and the printed results in the form of solid gypsum were measured using a digital caliper with an accuracy of 0.5 mm. Measurements are made at points that have been printed. To measure **AB or vertical distance** measured from the anterior, namely from the mesial of the left incisor to the mesiobuccal cusp of the left molar and to measure **BC or horizontal distance** measured from