

Literature Review

Effectiveness of Denture Cleansers for Removable Dentures: A Literature Review

Maqhfirah Amiruddin, Mohammad Dharma Utama, Chusnul Chotimah, Aditya Hari Asmara, Muh. Iqbal Shoaleh

Department of Prosthodontics, Faculty of Dentistry, Universitas Muslim Indonesia

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ABSTRACT

Introduction: The latest Indonesian Health Survey data indicate that 56.9% of the Indonesian population experiences dental and oral health issues, with 13.9% of individuals aged 15 years using complete dentures and 34.5% using partial dentures. An increased incidence of infection is associated with various predisposing factors, including denture use. *Candida albicans* is the primary etiological factor in denture stomatitis. This study aimed to evaluate the effectiveness of various types of denture cleansers.

Review: This study employed a literature review approach by collecting and synthesizing relevant scientific research articles. A synthesis of 19 scientific research articles indicates that effervescent tablets are more effective for denture cleaning than cleansing pastes and herbal solutions, because of their practicality and high effectiveness in reducing biofilms, microorganisms, and fungi. Effervescent granules are effective against *Streptococcus mutans* and *Candida albicans*, although their efficacy depends on the concentration of the active ingredients and the temperature of the dissolving solution. The use of denture cleansing paste may increase the surface roughness of acrylic plates beyond the standard threshold of 0.2 μm . Herbal solutions are effective for cleaning dentures and inhibiting bacterial and fungal growth.

Conclusion: Effervescent tablets are the preferred choice because of their high effectiveness in reducing biofilms, bacteria, and *Candida albicans*.

Corresponding Author:

Maqhfirah Amiruddin
Department of Prosthodontics, Faculty of Dentistry
Universitas Muslim Indonesia
Email: maqhfirah.amiruddin@umi.ac.id

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INTRODUCTION

Dental and oral health issues are a significant concern in Indonesia. The latest Indonesian Health Survey reported that 56.9% of the Indonesian population experiences oral health problems. Among individuals aged 15 years and older, 13.9% wear complete dentures and 34.5% wear partial dentures.¹ The increasing incidence of infections is associated with various predisposing factors, including denture use. *Candida albicans* is the primary etiological factor of denture stomatitis, a fungal infection that causes inflammation of the oral mucosa in denture wearers.²

Unclean dentures lead to increased plaque accumulation on the denture bases. Additionally, the rough surface of the denture base in contact with the mucosa serves as an attachment site for microbial plaque, contributing to denture stomatitis. Preventive measures for denture stomatitis include proper denture cleaning.^{3,4}

There are four main types of denture cleansers: effervescent tablets, effervescent granules, paste, and solution. Some herbal formulations contain active compounds such as alkaloids, flavonoids, phenols, tannins, saponins, xanthonenes, terpenoids, glycosides, and phlobatannins.⁵

Denture Stomatitis (DS) is frequently found, especially in patients who wear complete dentures.

The most common location for DS is the palatal mucosa; it is rare in the lower jaw due to the protective effect of saliva flow. DS is a common problem that typically occurs in denture wearers. This condition occurs, especially if dentures are worn all night and not removed during sleep. The prevalence of DS is higher in women than in men. According to several researchers in Switzerland, the prevalence of DS ranges from 11% to 67%.⁶

Although various denture cleanser formulations are available, there is limited research on their effectiveness. Some formulations may be more effective at removing plaque or specific bacteria but may be less effective in addressing other issues, such as discoloration or increased surface roughness of the denture base.

REVIEW

This study is a literature review of denture cleanser formulations. The article search was conducted using databases such as Google Scholar, DOAJ, PubMed, and Crossref, with the assistance of Publish or Perish software. The keywords used were denture cleanser formulations, microbial growth, and fungi. The articles selected for this study were limited to publications from the last ten years.

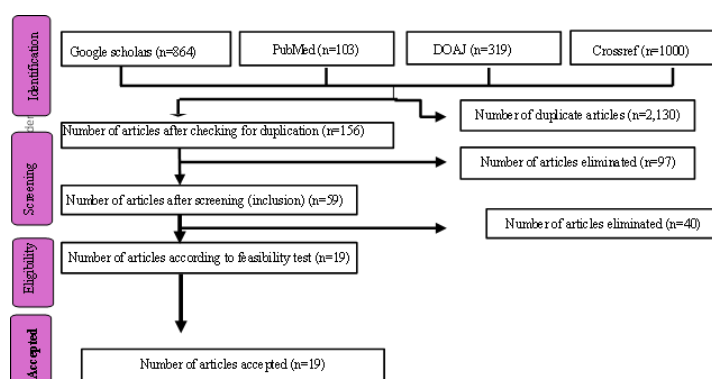


Figure 1. Article Selection Flow Diagram Based on PRISMA

A database search yielded 2,286 articles, of which 19 journals met the inclusion criteria. Table 1 presents a review of these articles, including

each study's publication year, title, research methodology, results, and conclusions.

Table 3.1 Synthesis of Journals on Combination Methods

No	Author(s)	Tahun	Year	Method	Results	Conclusion
1	Martinez Y, et al. ⁷	2024	Scientific evidence on the efficacy of effervescent tablets for cleaning removable prostheses. A systematic review and meta-analysis.	<i>Systematic Review</i>	The results show a significant effect of combining tooth brushing and effervescent tablets versus tooth brushing alone.	Combining tooth brushing with effervescent tablet use has a much greater effect in reducing biofilm and bacteria, and a moderate effect in reducing <i>Candida</i> .
2	Pertiwisari A, et.al. ³	2022	Effect of Immersion in 6.5% Effervescent Granules from Cocoa Pod Skin (<i>Theobroma Cacao</i> L.) on the Surface Roughness of Heat-Cured Acrylic Resin Plates	<i>True Experimental</i>	Independent t-test showed surface roughness before immersion was 0.206 and after immersion was 0.210.	Immersion in 6.5% effervescent granules from cocoa pod skin does not affect the surface roughness of heat-cured acrylic resin plates.
3	Nallaswamy, et.al. ⁸	2019	Effervescent denture cleansing granules using clove oil and analysis of its in vitro antimicrobial activity.	<i>Experimental laboratory.</i>	Effervescent granules mediated by clove oil showed dose-dependent antibacterial activity against microorganisms.	Effervescent denture cleaning granules can be used for routine denture cleaning, protecting denture wearers from infections like denture stomatitis.
4	Utama MD, et.al. ⁹	2021	Effect of Solvent Temperature in Effervescent Granule Denture Cleanser with Cacao Pod (<i>Theobroma cacao</i> L) 6,5% toward the Growth of <i>Streptococcus mutans</i> and <i>Candida albicans</i>	<i>True experimental.</i>	Significant effects of solvent temperature at 5-10°C, 20-25°C, and 25-31°C were observed on the growth of <i>Streptococcus mutans</i> and <i>Candida albicans</i> .	The most effective temperature in inhibiting <i>Streptococcus mutans</i> and <i>Candida albicans</i> growth was 20-25°C.
5	Alveno A, et.al. ¹⁰	2016	The Effect of Effervescent Pineapple Skin Extract Tablets on Inhibiting the Growth of <i>Candida albicans</i> on Heat-Cured Acrylic Resin	<i>True experimental.</i>	One-way ANOVA test showed significant differences in <i>Candida albicans</i> colony counts between treatment groups.	Effervescent pineapple skin extract tablets are effective as denture cleaners.
6	Machmud E. ¹¹	2018	Effectiveness of Roselle effervescent tablets as traditional medicinal plants in preventing growth of <i>Candida albicans</i> colonies and <i>Streptococcus mutans</i> .	<i>True experimental.</i>	10% roselle effervescent tablets showed no significant difference compared to sodium perborate effervescent tablets.	Roselle effervescent tablets are effective in preventing the growth of <i>Streptococcus mutans</i> and <i>Candida albicans</i> , similar to sodium perborate effervescent tablets.
7	Arieputri JA, Kristiana D, Parnaadji RR. ¹²	2019	Effectiveness of Effervescent Mangosteen Peel Extract Tablets as a Cleaning Agent for Acrylic Resin Dentures Against <i>Candida albicans</i>	<i>Experimental laboratory.</i>	Soaking in 60% effervescent mangosteen peel extract tablets for 15 minutes was effective as a denture cleaner.	The most effective concentration and soaking time for cleaning acrylic resin dentures against <i>Candida albicans</i> is 60% mangosteen peel extract soaked for 15 minutes.

8	Noviyanti. Et.al. ¹³	2018	Effectiveness of Robusta Coffee Bean Paste as a Denture Cleaner on the Surface Roughness of Heat-Cured Acrylic Resin	<i>Experimental laboratory.</i>	Robusta coffee bean paste was less effective as a denture cleaner for surface roughness of heat-cured acrylic resin.	Robusta coffee bean paste is less effective in cleaning dentures for reducing surface roughness of heat-cured acrylic resin.
9	Hidayati L, et.al. ¹⁴	2023	Effectiveness of Tobacco Leaf Paste as a Denture Cleaner on the Surface Roughness of Heat-Cured Acrylic Resin	<i>Experimental laboratory.</i>	Tobacco leaf paste was less effective as a denture cleaner for reducing the surface roughness of acrylic resin.	Tobacco leaf paste is less effective for cleaning heat-cured acrylic resin dentures, producing surface roughness values far above the ideal surface roughness threshold.
10	Evan G, et.al. ¹⁵	2015	Color Change of Acrylic Base after Using Roselle Denture Cleaning Paste	<i>Clinical Experimental</i>	Wilcoxon test showed a p-value of < 0.05, indicating a significant change in the acrylic base color.	Changes in the color of acrylic denture bases occur after using roselle denture cleaning paste.
11	Utama MD, et.al. ¹⁶	2020	Color stability of denture acrylic base after cleaning with rosella flower extract toothpaste	<i>Time series</i>	No significant color change was observed at 2.5%, 5%, and 10% concentrations (p > 0.05).	No significant color change occurred after cleaning acrylic base dentures with roselle flower extract toothpaste.
12	Naini A, et.al. ¹⁷	2023	Potential of tobacco leaf extract paste (<i>Nicotiana tabacum</i> L.) as a denture cleanser to prevent denture stomatitis.	<i>Experimental laboratory</i>	75% tobacco leaf paste effectively inhibits <i>Candida albicans</i> and has potential as a denture cleanser to prevent denture stomatitis.	75% tobacco leaf paste is effective in inhibiting <i>Candida albicans</i> growth
13	Amiruddin et.al. ¹⁸	2024	Effectiveness of Ajwa Date Palm Extract Mouthwash Solution Against <i>Streptococcus mutans</i> and <i>Candida albicans</i>	<i>True experimental</i>	Significant effects were observed at concentrations of 3.25%, 6.5%, 12.5%, 25%, and 50%.	Ajwa date palm extract mouthwash with a concentration of 3.25% is highly effective in inhibiting the growth of <i>Streptococcus mutans</i> and <i>Candida albicans</i> .
14	Balaff FF, et.al. ²	2024	The Effect of Mouthwash Use in Managing Denture Stomatitis	<i>Narrative review</i>	Chlorhexidine mouthwash was found to be more effective against <i>Candida albicans</i> . Chlorhexidine is bacteriostatic at low concentrations and bactericidal at high concentrations.	Mouthwashes containing nystatin, chlorhexidine, indocyanine green (ICG), and chitosan curcumin-free alcohol can reduce microorganisms on dentures and prevent and treat denture stomatitis.
15	Salles M, et.al. ¹⁹	2015	Antimicrobial action of sodium hypochlorite and castor oil solutions for denture cleaning - in vitro evaluation	<i>Experimental laboratory</i>	Sodium hypochlorite solutions at 0.25% and 0.5% were effective in removing all microorganisms upon application for short soaking durations (20 min)	Short soaking in sodium hypochlorite solutions (0.25% and 0.5%) is effective for removing pathogens from denture biofilms and may be useful for cleaning full dentures.
16	Melisa. ¹⁹	2023	Various Methods and Materials for Cleaning Removable Dentures	<i>Literature Review</i>	Chlorhexidine gluconate or salicylate solutions can reduce plaque accumulation on dentures and improve mucosal health in patients with <i>Candida</i> denture stomatitis.	Chlorhexidine solutions can cause severe discoloration of dentures, making them unsuitable for routine denture cleaning.

17	Badaró et al., 2019	2014	Trial of an Experimental Castor Oil Solution for Cleaning Dentures	Experimental laboratories	Polident and castor seed solutions showed comparable results in removing biofilm from full dentures.	Castor seed solution showed similar effectiveness to alkaline peroxide in removing biofilm from complete dentures.
18	Ibrahim I, et.al. ²²	2016	Effect of Soaking Duration in Chlorhexidine Solution on Color Change of Heat-Cured Acrylic Resin	Experimental	Significant color differences were observed between 30 and 45-minute soaking durations.	Soaking heat-cured acrylic resin in chlorhexidine solution for 45 minutes results in significant color fading.
19	Sitorus V. ²³	2024	Effect of Soaking Heat-Cured Acrylic Resin Denture Base in Cymbopogon nardus (Lemongrass) Extract and Chlorhexidine on Surface Roughness	Experimental laboratory	25% Cymbopogon nardus extract resulted in lower surface roughness values than chlorhexidine.	Cymbopogon nardus 25% extract can be recommended as an alternative denture cleaner for heat-cured acrylic resin bases.

A database search yielded 2,286 articles, of which 19 journals met the study criteria. Table 1 presents a review of these articles, including the publication year, article title, research methodology, results, and conclusions of each study. Research has shown that immersion in 6.5% cocoa pod husk effervescent granules does not affect the surface roughness of heat-polymerized acrylic resin plates.³ Effervescent granules containing clove oil have been found effective against *Candida albicans*.⁸ Similarly, a study on 6.5% cocoa pod husk (*Theobroma cacao* L.) effervescent granules indicated that a solvent temperature of 20–25°C effectively inhibits the growth of *Streptococcus mutans* and *Candida albicans*.⁹ Research also demonstrated that effervescent tablets made from pineapple peel extract effectively combat *Candida albicans*. This finding aligns with studies on 10% roselle effervescent tablets and sodium perborate, which were found to be equally effective in inhibiting the growth of *Streptococcus mutans* and *Candida albicans*, comparable to sodium perborate effervescent tablets.¹⁰ Additionally, studies on 60% extract effervescent tablets immersed for 15 minutes confirmed their efficacy in reducing *Candida albicans* populations.¹¹ In contrast, research on 25% and 50% robusta coffee seed paste showed limited effectiveness as a denture cleanser in reducing the surface roughness

of heat-cured acrylic resin.¹² This result is consistent with studies on 75% tobacco leaf paste, which also demonstrated limited effectiveness as a denture cleanser in reducing the roughness of acrylic resin denture bases (RAPP).¹³ Studies on roselle-based cleansers revealed color degradation in acrylic denture bases after six to nine months of using roselle denture cleansing paste.¹⁴ However, this finding contradicts research on 2.5%, 5%, and 10% roselle flower extract paste, which reported no significant color change in acrylic denture bases after cleaning with roselle extract.¹⁵ Moreover, a study on 75% tobacco leaf paste confirmed its effectiveness in inhibiting *Candida albicans*.¹⁶

Research involving ajwa date fruit extract mouthwash at concentrations of 3.25%, 6.5%, 12.5%, and 25% demonstrated effective inhibition of *Streptococcus mutans* (average inhibition zone: 20.75 mm) and *Candida albicans* (11.26 mm).¹⁷ A literature review indicated that mouth rinses containing nystatin, chlorhexidine, indocyanine green (ICG), and alcohol-free curcumin chitosan effectively reduce microbial counts on dentures.¹⁸ However, studies have noted that chlorhexidine solutions cause denture discoloration, making them unsuitable for denture cleansing.¹⁹ This aligns with findings that immersion in chlorhexidine solution

for up to 45 minutes significantly alters the color of chrome denture bases.²⁰

Furthermore, studies on sodium hypochlorite (NaOCl) solution demonstrated the highest biofilm removal efficiency (median 0%), while 2% castor oil solution had comparable effectiveness to alkaline peroxide-based Polident tablets (median 1.5% and 1%, respectively).²¹ However, 10% castor oil solution exhibited strong antibacterial activity against *Bacillus subtilis* but was less effective against *Enterococcus faecalis*.²² Additionally, 25% lemongrass extract solution resulted in lower surface roughness values compared to 0.2% chlorhexidine.²³

CONCLUSIONS

A literature review indicates that effervescent tablets are the most effective and efficient denture cleansers compared to granules, paste, and disinfectant solutions. Effervescent tablets are superior for denture cleaning because of their practicality and high efficacy in reducing biofilms, microorganisms, and fungi. Effervescent granules are effective against *Streptococcus mutans* and *Candida albicans*, although their effectiveness depends on the concentration of active ingredients and the temperature of the solvent used. The use of denture cleansing pastes increased the surface roughness of acrylic plates beyond the standard threshold of 0.2 µm. Herbal solutions are effective in cleaning dentures and inhibiting bacterial and fungal growth.

This literature review should incorporate more international journal sources to broaden perspectives and enhance data validity.

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