

ORIGINAL ARTICLE



Comparative evaluation of surface roughness on heat cure denture base resin by two different denture cleansers

Amitkumar Shamlal Bajaj, Mukesh Kumar Goyal, Geeta Paul, Isha Saxena, Madhav and Shalini Chauhan

Department of Prosthodontics and Crown & Bridge, Inderprastha Dental College and Hospital, Ghaziabad, Uttar Pradesh

ABSTRACT

Background: Maintaining denture hygiene is essential for preventing microbial colonization and denture stomatitis. Chemical denture cleansers are routinely used, but their long-term effect on denture base resin remains a concern. This study compared the effect of two denture cleansers Fittydent and Clinsodent on the surface roughness of heat-cure polymethyl methacrylate (PMMA) resin.

Aim: To compare and evaluate the effect of two commercially available denture cleansers—Fittydent and Clinsodent on the surface roughness of heat-cure polymethyl methacrylate (PMMA) denture base resin after a 2-month immersion period.

Materials and Methods: Twenty-two standardized PMMA discs (12 × 2 mm) were fabricated following ADA specification No. 12. Samples were randomly divided into two groups (n = 11). Group A samples were immersed in Fittydent solution daily, while Group B samples were immersed in Clinsodent solution. Immersion lasted 30 minutes daily for 2 months, with solutions freshly prepared each day. Surface roughness was evaluated at baseline and after 2 months using a calibrated Taylor Hobson Surtronic 3+ profilometer (cut-off length 0.8 mm, 5 µm diamond stylus). Data were analyzed using SPSS V 27, with significance set at $p \leq 0.05$.

Results: Both cleansers significantly increased PMMA surface roughness ($p < 0.001$). Fittydent caused a greater increase (mean $\Delta Ra = 0.23 \mu m$) compared to Clinsodent (mean $\Delta Ra = 0.13 \mu m$). ANOVA confirmed a significant intergroup difference ($p < 0.001$).

Conclusion: Fittydent produced greater surface degradation than Clinsodent. The milder effect of Clinsodent indicates it may be preferable for long-term denture use.

KEY WORDS

Denture cleansers;
Effervescent tablets;
Polymethyl methacrylate;
Surface roughness

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Introduction

Maintaining denture cleanliness is crucial for preventing plaque accumulation, Candida colonization, denture stomatitis, and halitosis. Heat-cure PMMA remains the material of choice for denture bases; however, surface roughness greater than $0.2 \mu m$ significantly increases microbial adhesion. Chemical denture cleansers offer efficacy in areas inaccessible to mechanical cleaning but may also alter PMMA surface characteristics depending on their oxidizing potential [1].

With the rising prevalence of removable prostheses among geriatric and medically compromised patients, maintaining optimal denture hygiene has become a clinical priority. Heat-cure PMMA remains the most widely used denture base material owing to its favorable physical properties, yet its surface is susceptible to microbial colonization particularly when surface roughness exceeds $0.2 \mu m$ [2]. Increased roughness enhances plaque retention, promoting biofilm formation and predisposing to conditions such as denture stomatitis, angular cheilitis, halitosis, and, in severe cases, systemic infections.

Mechanical cleaning methods, including brushing and ultrasonic devices, physically remove debris and biofilm but are often insufficient for inaccessible or contoured areas. Consequently, chemical denture cleansers commonly formulated with oxidizing agents, detergents, or antifungal

components are frequently used as adjuncts. While effective against microorganisms, repeated exposure to these agents may adversely affect PMMA, altering its surface characteristics, mechanical strength, and aesthetics [3]. Sodium hypochlorite-based cleansers provide strong antimicrobial action but may cause surface pitting, color change, and increased roughness. In contrast, effervescent peroxide-based cleansers generally produce fewer surface alterations but may be less potent against resilient biofilms. Thus, cleanser composition plays a critical role in balancing antimicrobial efficacy with preservation of denture base integrity. Despite widespread use of commercial cleansers, limited evidence compares the material-preserving capabilities of effervescent cleansers [4].

Although several studies have evaluated the effects of denture cleansers on PMMA, there is limited comparative evidence specifically assessing the long-term effect of Fittydent and Clinsodent on surface roughness using standardized immersion protocols and calibrated profilometric analysis. The scarcity of direct head-to-head comparisons leaves uncertainty regarding which cleanser is safer for routine long-term denture hygiene [5,6].

There is no significant difference in the effect of Fittydent and Clinsodent on the surface roughness of heat-cure PMMA resin. The present in vitro study compares the effects of two

*Correspondence: Dr. Mukesh Kumar Goyal, Department of Prosthodontics and Crown & Bridge, Inderprastha Dental College and Hospital, Ghaziabad, Uttar Pradesh, e-mail: dr.mukeshgoyal@gmail.com

commercially available denture cleansers Fittydent and Clinsodent on the surface roughness of heat-cure PMMA resin. Using standardized immersion protocols and profilometric analysis, the study aims to generate clinically relevant data to guide recommendations for long-term denture care, particularly for elderly individual's dependent on chemical cleaning methods [7].

Materials and Methods

A total of 22 heat-cure PMMA resin discs were fabricated for this study. Each disc measured 12 mm in diameter and 2 mm in thickness, prepared using a precision stainless-steel mold to ensure uniformity in accordance with ADA Specification No. 12. The mold assembly was invested in a metallic flask using Type II dental gypsum, which served as a stable support medium during processing. After the gypsum had completely set, the wax was eliminated by controlled heating to create a clean and well-defined mold cavity (Figure 1). A thin, even layer of separating medium was applied to the gypsum to prevent acrylic adhesion and facilitate easy retrieval.

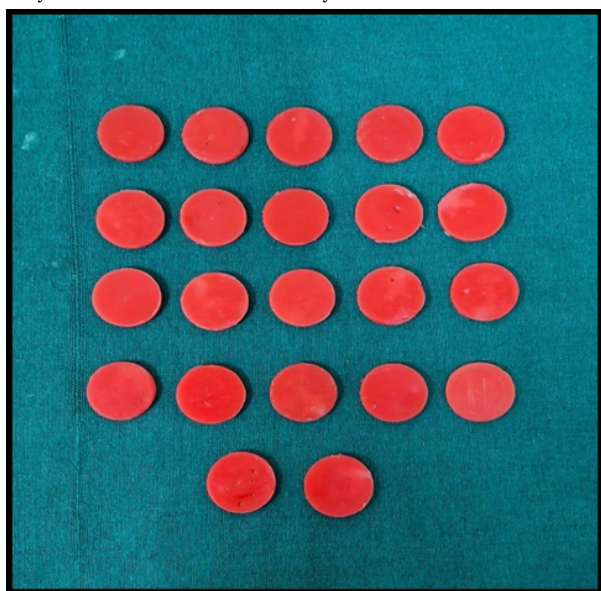


Figure 1. Disc shaped wax pattern.

Heat-polymerized PMMA acrylic resin (DPI Heat Cure, India) was then packed into the mold and processed using a standardized two-stage polymerization cycle:

- 70°C for 60 minutes, followed by
- 90°C for 30 minutes

to ensure complete polymerization and minimize residual monomer content. This protocol was repeated identically for all 22 samples to maintain methodological consistency.

Following polymerization, the discs were carefully deflashed and retrieved to avoid introducing surface defects. Finishing and polishing were performed using a standardized sequential protocol: excess material was removed with rotary instruments, after which the surfaces were smoothed with graded silicon carbide abrasive papers under water cooling, progressing from coarse to fine grit. Final polishing was carried out using a pumice slurry on a soft rag wheel at low speed to achieve a uniform, clinically acceptable smoothness. To further reduce residual monomer and simulate intraoral conditions, all

samples were stored in distilled water at 37°C for 24 hours (Figure 2).

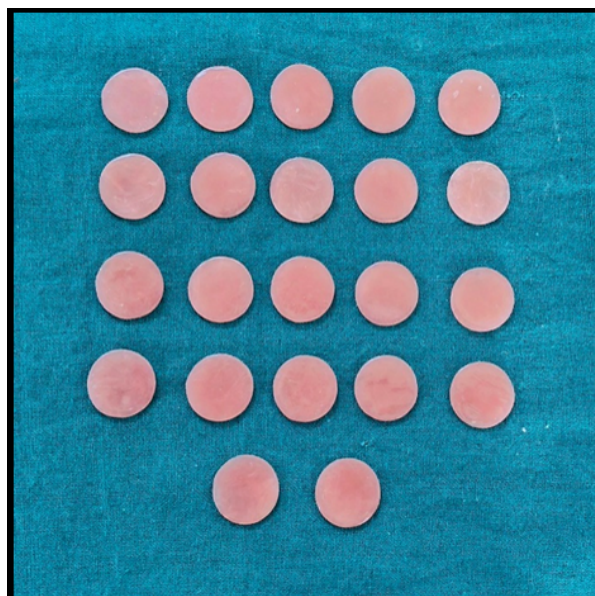


Figure 2. Finished and polished samples.

- **Group A:** Immersed in Fittydent solution (one 480 mg tablet, Dr. Reddy's Laboratories Ltd., India, dissolved in 50 mL warm water)
- **Group B:** Immersed in Clinsodent solution (ICPA Health Products Ltd., India, prepared similarly)

Cleansing solutions were freshly prepared each day following manufacturer instructions. Each sample was immersed for 30 minutes daily for 2 months, simulating routine patient use (Figure 3). After each immersion cycle, specimens were rinsed thoroughly under running tap water, gently dried using absorbent paper, and subsequently stored individually in distilled water at room temperature to prevent dehydration and mimic oral moisture conditions.



Figure 3. Samples dipped in Clinsodent & Fittydent tablet denture cleanser.

Surface roughness (Ra) was measured for all discs at baseline and after the 2-month immersion period using a calibrated Taylor Hobson Surtronic 3+ surface profilometer (Figure 4). The instrument uses a precision 5 µm diamond stylus and a 0.8 mm cut-off length, traversing the specimen surface to detect micro-topographical variations. For each

disc, three readings were recorded at standardized orientations, and their mean value was taken as the representative Ra score. This ensured reliable detection of subtle surface alterations associated with prolonged exposure to denture cleansers.

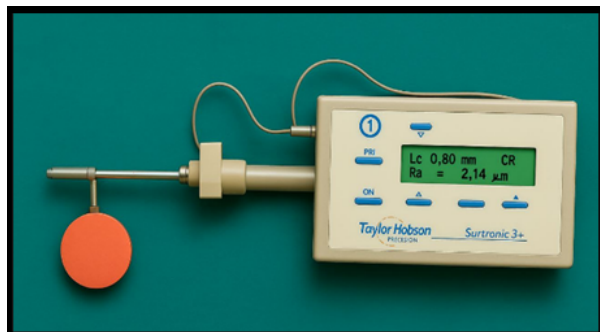


Figure 4. Sample being tested on Profilometer.

All collected data were subjected to statistical analysis using SPSS version 27. Descriptive statistics (mean $\pm$ standard deviation) were calculated for each group. Paired t-tests assessed intragroup changes over time, while a one-way ANOVA evaluated intergroup differences, with the level of statistical significance set at $p \leq 0.05$.

Results

In this in vitro study, both denture cleansers Fittydent and Clinsodent produced a statistically significant increase in the surface roughness of heat-cure PMMA denture base resin after two months of daily immersion ($p < 0.001$ for both groups, paired t-test) (Table 1).

Table 1. Evaluation and comparison between the effect of Fittydent tablet on the surface roughness of heat polymerized acrylic resin (paired t-test).

Fittydent	Mean $\pm$ SD	Mean Difference $\pm$ SD	t-value	p-value, S/NS
Before	0.43 $\pm$ 0.032	-0.23 $\pm$ 0.031	-24.757	<0.001, HS
After	0.66 $\pm$ 0.046			

$p \leq 0.05$ – Significant, CI = 95 %

For the Fittydent group, mean surface roughness increased from 0.43 $\pm$ 0.032 μm to 0.66 $\pm$ 0.046 μm , with a mean difference of 0.23 $\pm$ 0.031 μm ($t = -24.757$, $p < 0.001$). For the Clinsodent group, mean surface roughness increased from 0.73 $\pm$ 0.698 μm to 0.86 $\pm$ 0.724 μm , with a mean difference of 0.13 $\pm$ 0.044 μm ($t = -9.939$, $p < 0.001$) (Table 2).

Table 2. Evaluation and comparison between the effect of Clinsodent tablet on the surface roughness of heat polymerized acrylic resin (paired t-test).

Clinsodent	Mean $\pm$ SD	Mean Difference $\pm$ SD	t-value	p-value, S/NS
Before	0.73 $\pm$ 0.698	-0.13 $\pm$ 0.044	-9.939	<0.001, HS
After	0.86 $\pm$ 0.724			

$p \leq 0.05$ – Significant, CI = 95 %

Intergroup comparison using one-way ANOVA revealed a statistically significant difference between the two cleansers ($F = 38.668$, $p < 0.001$), with Fittydent causing a greater increase in surface roughness than Clinsodent. These findings indicate that while both cleansers alter PMMA surface integrity, the oxidizing potential and chemical composition of Fittydent result in a more pronounced erosive effect. Clinsodent, with its

comparatively milder impact, may be more suitable for routine long-term denture hygiene (Table 3) (Figure 5).

Table 3. Comparison between the effect of Fittydent and Clinsodent tablet on the surface roughness of heat polymerized acrylic resin.

Before-After	Mean $\pm$ SD	F-value	p-value, S/NS
Fittydent	0.23 $\pm$ 0.031		
Clinsodent	0.13 $\pm$ 0.044	38.668	<0.001, HS

$p \leq 0.05$ – Significant, CI = 95 %

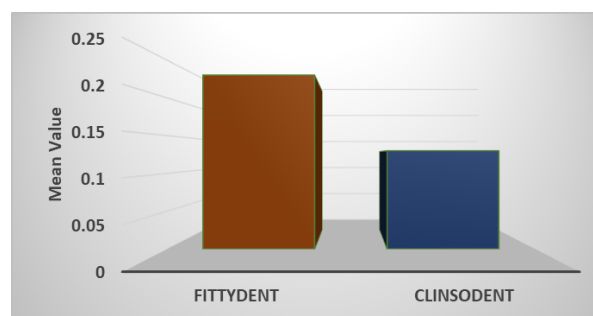


Figure 5. Comparison of mean surface roughness of PMMA after immersion in fittydent and clinsodent.

Discussions and Limitations

This study evaluated the effect of two commonly used effervescent denture cleansers Fittydent and Clinsodent on the surface roughness of heat-cured PMMA denture base resin. Surface roughness plays a crucial role in biofilm adhesion, microbial colonization, and the development of denture stomatitis. A roughness threshold above 0.2 μm significantly increases microbial retention, including Candida species, thereby compromising oral health and prosthesis longevity.

The present findings demonstrated that both denture cleansers significantly increased PMMA surface roughness, consistent with recent evidence indicating that repeated exposure to peroxide-based or effervescent cleansing agents leads to micro-pitting, resin matrix softening, and surface degradation. The increased roughness is attributed primarily to sustained oxidative action, which disrupts polymer integrity and causes minor material dissolution over time [8].

Fittydent exhibited a more pronounced increase in roughness than Clinsodent, reflecting its higher oxidizing potential and sodium perborate-based effervescence. This aligns with contemporary studies reporting that oxygen-liberating cleansers lead to greater topographical alteration compared to milder formulations [9,10].

In contrast, Clinsodent produced comparatively lower roughness values, suggesting a gentler interaction with the PMMA surface. Recent literature supports the preference for milder effervescent cleansers to reduce long-term deterioration of denture base materials, particularly in elderly patients who rely heavily on daily chemical cleansing. Reduced surface degradation helps minimize microbial adhesion, decreases the risk of denture stomatitis, and preserves prosthesis longevity [11,12].

The results emphasize the need to balance antimicrobial efficacy with material preservation. While both cleansers remain suitable for clinical use, Clinsodent appears to provide safer long-term outcomes, especially for patients requiring prolonged immersion or those with limited manual dexterity [13].

Limitations

- In vitro conditions cannot fully replicate intraoral factors such as temperature fluctuations, salivary enzymes, and masticatory forces.
- Only two commercial cleansers were evaluated.
- Long term effects beyond 2 months were not assessed.
- Ethical approval details await the final approval number [14].

Conclusion

Within limitation of the study, it can be concluded that Fittydent caused a greater increase in surface roughness compared to Clinsodent, indicating a more pronounced erosive effect on the denture base material. The chemical composition of the cleanser plays a vital role in surface alteration, with Fittydent's effervescent and oxidizing properties contributing more aggressively to surface degradation. Based on surface preservation, Clinsodent may be considered a safer alternative for routine use in denture hygiene, especially for long-term denture wearers.

Clinical Significance

Maintaining a smooth denture base surface is critical to minimize plaque accumulation, microbial colonization, and denture stomatitis risk. Chemical cleansers, while essential for hygiene, can alter surface integrity, influencing prosthesis longevity and patient comfort. Choosing milder cleansers like Clinsodent reduces erosive damage to PMMA and supports long-term denture use. These findings guide clinicians in recommending appropriate cleansers for geriatric and medically compromised patients.

Disclosure Statement

The author does not have conflict of interest in this research.

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