

Original Article

A comparative study for plaque removing efficacy between commonly used denture cleansers in India

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Abstract

Aim: A comparative study for plaque removing efficacy between toothpaste, liquid handwashing soap, and two chemical-soak denture cleansers (clinsodent denture cleansing powder and fittydent denture cleansing tablet).

Materials and Methods: A total of 140 healthy complete denture patients were selected and checked for denture cleansing using toothpaste, liquid handwashing soap, and two chemical denture cleansers: Clinsodent powder and fittydent tablets. Cleansing with plain water was kept as control for twenty patients.

Results: The data were analyzed using Wilcoxon signed ranks test for checking the efficacy. The Kruskal–Wallis test was used for comparing the plaque removing efficacies of each denture cleanser used in the study. All four denture cleansers were significantly effective in removing plaque when compared with plain water, but there was no significant difference among them.

Conclusions: There was no significant difference among action of four denture cleansers used in this study. Thus we can infer that patients can use liquid handwashing soap or commercial products to overcome disadvantages of toothpastes. Recommendation from the results of this study is the use of liquid handwashing soap for cleansing after every meal and soaking of the denture in commercial denture cleanser during the night.

Keywords: Clinsodent powder, denture plaque, fittydent tablet, liquid handwashing soap, tooth brush, toothpaste

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INTRODUCTION

The use of heat cure acrylic resin for denture fabrication is a common procedure; however, it has a micro-porous surface which provides a favorable platform for micro-organisms to organize “denture plaque.” It also acts as a plaque

applicator, by holding the plaque in contact with the oral mucosa for extended periods of time, thereby increasing the toxic effects, leading to mucosal abnormalities such as denture stomatitis, chronic candidiasis, and inflammatory papillary hyperplasia.^[1] When this intimate relationship is interrupted; the tissue health improves, and the most

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common method of controlling this interface is good denture hygiene, which can be achieved with the proper denture cleansing practice.^[1]

The term, “denture plaque” has been used throughout the literature. However, the term “plaque on denture” should be used because the microbial flora and its pathogenicity of denture plaque resemble those of plaque formed on the tooth surface, so-called dental plaque. In addition, the term “denture-related stomatitis” would be preferable to “denture-induced stomatitis,” since the inflammation of (palatal) mucosa is not induced by the denture, but by wearing the denture or by plaque on the denture.

For being effective, a denture cleanser must be capable of removing plaque from not only the polished surfaces of prosthesis but more importantly from the unpolished tissue surfaces. Denture cleansers can be broadly divided into mechanical, chemical, and both; based on their mode of action.^[2] Toothpaste is most commonly used denture cleanser, but toothpaste may cause damage to acrylic resin making it rough, thus more prone to plaque accumulation. To overcome this drawback, chemical cleansers are frequently advocated by authors. Likewise, in geriatric patients, because of lack of manual dexterity due to age, chemical methods are more advisable.^[3]

Prescription/recommendation of specific denture cleanser to the patient is often based on exposure or knowledge of the clinician because there is no laid down protocol for denture hygiene procedure. So, the aim of the conducting this study was to set a denture hygiene practice which operator can explain at the time of denture insertion. Before starting this study, a pilot project was conducted among 80 denture wearers to know what mode of denture cleansing they have adopted and the reason for it. Results showed that 43% people were using toothpaste, 36% liquid handwashing soap, 12% commercially available denture cleansers, 4% dishwashing cake and 5% were cleansing their denture with plain water only. The reason for using toothpaste was their own presumption of cleaning the denture with the same agent, which they used for their natural teeth and only in few cases, it was advised by their dentists; however, liquid handwashing soap was advised mostly by their dentists. Commercial chemical denture cleansing products were prescribed by few dentists only and reason could be less promotion of the product to professionals, less availability for the general public in the Indian market and their high cost.

So keeping in mind all these findings and limitations, this study was designed to compare the plaque removing efficacy between commonly used denture cleansers among the local

population and these are toothpaste, liquid handwashing soap and two easily available and cost effective chemical-soak denture cleansers (clinsodent denture cleansing powder and fittydent denture cleansing tablet).

MATERIALS AND METHODS

All complete denture wearer patients, in the age group of 40–70 years registered with the department records at military dental center were recalled and 160 among them who were fulfilling the inclusion criteria (like well-fitting dentures, minimum 6 months of duration of their use) and exclusion criteria (like lack of systemic disease causing oral manifestations or xerostomia, etc., and manual dexterity because these can alter study results) were selected for the study after obtaining informed consent. Ethical clearance was taken from the concerned local body in Military Hospital, Pathankot (Punjab).

One hundred and forty subjects were included in treatment groups and evaluated with four selected denture cleansers, and twenty subjects (randomly selected) were taken as control baseline group (only plain water was used for denture cleansing).

Denture cleansers used were Tooth Paste (Colgate, Strong Teeth Colgate – Palmolive India Ltd., Bombay), Liquid Hand Washing Soap (Dettol Original), Denture Cleansing Tablets (Fittydent Denture Cleansing Tablets by Dr. Reddy’s Laboratories Ltd., Hyderabad), Denture Cleansing Powder (Clinsodent - The Scientific Denture Cleanser, ICPA Health Products Ltd., Aankleshwar). All these agents were used with Soft Denture Brush (STIM Brushes Dent Aids, New Delhi).

Procedure was divided into pretest session and test session.

Pretest session

After completion of necessary adjustments, all the maxillary dentures were ultrasonically (Ultrasonic Cleaner [Citizon] with Solution-UNI 77 RENFERT GMBH, Germany) cleansed for 30 min to perform a uniform baseline. Subjects were informed that they should not remove and clean their denture in any manner for 24 h (for building up of plaque) before all test sessions. They were only allowed to wash their denture in running plain water. Patients were re-called after 24 h for test session.

Test session

One hundred and forty patients were randomly divided into four groups; having 35 patients in each group.

Test regimens were used as scheduled in Table 1.

Table 1: Denture cleansers were sequentially arranged in different order to prevent bias due to overlapping of action

Group	Day 1 (control baseline)	Day 2 (treatment group)	Day 3 (treatment group)	Day 4 (treatment group)	Day 5 (treatment group)
Group 1	Plain water	Tooth paste	Liquid handwashing soap	Clinsodent powder	Fittydent tablet
Group 2	Plain water	Liquid handwashing soap	Clinsodent powder	Fittydent tablet	Tooth paste
Group 3	Plain water	Clinsodent powder	Fittydent tablet	Tooth paste	Liquid handwashing soap
Group 4	Plain water	Fittydent tablet	Tooth paste	Liquid handwashing soap	Clinsodent powder

Methods

At the test session, the maxillary dentures with 1 day accumulated plaque were coded and rinsed in slow running tap water to remove any loose food debris. Tissue surface of maxillary denture was divided into four sections approximately equal in area as shown in Figure 1. Plaque disclosing agent (DPI Alpha Plac [Two Tone Disclosing Solution] Dental Products of India Ltd., Bombay) was poured on the tissue surface. After 2 min, it was washed under running tap water for 1 min. Precleansing plaque score was given for each quadrant using modified Quigley-Hein Scale [Table 2]. Test regimens were used for cleansing the denture as scheduled in Table 1. The method of use is described in Table 3. After cleansing, the disclosing agent was poured for 2 min then it was washed for 1 min in running tap water. Postcleansing score was given for each quadrant. At the end of each session, denture was cleansed in an ultrasonic cleanser for 30 min to maintain baseline for next test session. The patient was recalled after 24 h for next test session after instructing them not to clean their denture.

Plaque scoring

Each quadrant area was considered as 100%. The area covered by disclosed plaque (by using disclosing solution) was visually inspected for giving plaque score. Every quadrant was scored individually then total plaque was obtained for each denture by adding all 4 quadrant scores. So, total readings were 560 for each test groups (140 subject dentures × 4 quadrants in each denture) and 80 for the control group (20 subject dentures × 4 quadrants in each denture). The complete procedure was carried out by a single examiner, but scores were given by two observers. The second observer was explained about methodology and plaque scoring method in advance.

RESULTS

Two observers were included in this study for giving plaque scores to prevent observer bias. The reliability was checked between plaque scores given by observer I and observer II by using Spearman's rank correlation coefficient technique. Reliability factor was more than 94%, so for further calculations, only readings of observer 1 were considered. As successive appointments were given to patients at a

Table 2: Modified Quigley-Hein Scale

Modified Quigley-Hein Scale (denture plaque index by visual scoring method)	
0 = No plaque	
1 = Light plaque	≤25% area covered with remaining plaque
2 = Moderate plaque	26%-50% area covered with remaining plaque
3 = Heavy plaque	51%-75% area covered with remaining plaque
4 = Very heavy plaque	≥76% area covered with remaining plaque

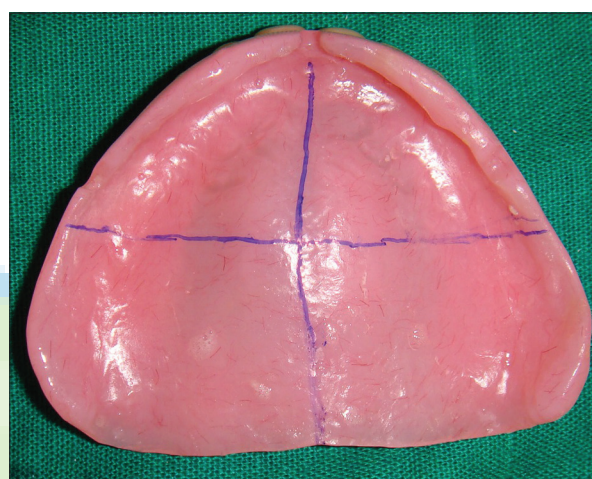
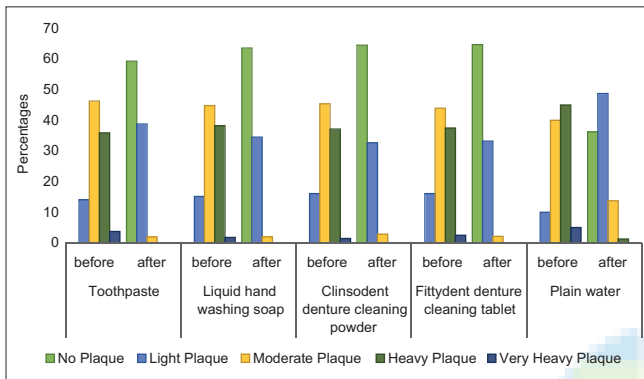


Figure 1: Tissue surface of maxillary denture is divided into four equal parts

shorter interval (24 h) of time, so chances were there for overlapping of action of previously used cleanser. To overcome this bias, total numbers of patients were randomly divided into four groups and all four denture cleansers were used for each denture in every group in different sequences in this study to minimize every kind of bias. To compare between different cleansing agents a uniform baseline is required so precleansing plaque score. Wilcoxon signed ranks test applied on pre- and post-cleansing scores and results showed that there is a significant reduction in plaque when used any of the cleansing agents and even with plain water when used alone (control group) [Graph 1]. The reason for this finding could be the short duration between recall visits which might not be adequate enough for organisation and adherence of the plaque on denture surface; so was easily removed with denture brush without any adjunct. However for finding a comparison between efficacies of different cleansing agents used, first, we need to create a uniform baseline. For that Kruskal–Wallis test was applied

Table 3: Methodology of use of different agents used

	Regimen used	Quantity	Method of use
Control baseline group (n=21)	Plain water	Slow running tap water	Wet brushing was done with 80 strokes/min in antero-posterior direction only
Treatment group (n=51)	Tooth paste	15 mm of length	Tooth paste was used with brush (80 strokes/min in antero-posterior direction only)
	Liquid hand washing soap	1 tea spoon	Soap was used with brush (80 strokes/min in antero-posterior direction only)
	Clinsodent denture cleansing powder	1 tea spoon full of powder	Powder was mixed in 300 ml warm water (45°C) and denture was put in it at 45°C for 12 min (in water bath with thermostat-confident dental equipment Ltd., Bangalore) and after that brushing was performed for 1 min with 80 strokes/min
	Fittydent denture cleansing tablet	1 tablet	Tablet was mixed in 300 ml warm water (45°C) and denture was put in it at 45°C for 12 min and after that brushing was performed for 1 min with 80 strokes/min



Graph 1: Plaque removing efficacy of commonly used denture cleansers

on precleansing plaque scores found that difference among their scores was not significant so that we could use their postcleansing scores for comparison. Again, Kruskal–Wallis test was applied (on the difference between post- and pre-cleansing score) to compare the cleansing efficacy and found that there is no significant difference between plaque removing capability of used agents in this study. However, Mann–Whitney test showed that all agents are significantly effective in removing plaque when compared with plain water (control group).

DISCUSSION

Numerous clinical studies have demonstrated the relationship between denture plaque, mucosal inflammation, and denture-induced stomatitis.^[1,2] It is well established that the use of denture cleansers helps control or eliminate these conditions by reducing the amount of plaque residing on denture surfaces.^[1] Denture cleansers can be of various types based on their main component like alkaline peroxides, alkaline hypochlorite, acids, disinfectants, enzymes, etc.^[2]

Tooth paste is most commonly used the product for cleansing natural teeth. With that psychology, easy

availability and cost effectiveness, toothpaste is commonly used by patients to clean their denture.^[4] Even in the pilot study, done before this present study showed that it is most commonly followed method by patients (by 43%). Although various authors have claimed that brushing with toothpaste may cause damage to the acrylic resin.^[5] However, brushing with a low abrasive paste like pumice is quite effective in removal of the plaque deposits and has a polishing effect on the denture surface, which in turn would render the denture less subject to plaque reaccumulation,^[6] but its use requires powered buff and is not user-friendly. This study showed toothpaste equally effective to chemical cleansers; However, this observation does not support the findings of Dills *et al.*^[4] where they found soaking denture cleanser more effective in reducing plaque than denture paste. In contrary, Tarbet *et al.*^[6] and Abelson^[2] found paste to be more effective than soak type denture cleanser.

Liquid handwashing soap is second most commonly used denture cleansing product in plot study data (36%) and is advised by dentist in most of the cases however, use is not documented in clinical studies. Results of this study proved it a safe, quick, and excellent denture cleansing alternative toothpaste. Although, commercial denture cleansing products are advocated in most of the clinical trials but there are two distinct shortcomings of their use. First, these are expensive for regular use and the other being difficulty in the procurement everywhere in the Indian market. Twelve percent of patients in our pilot study were using chemical denture cleansers. Chemical cleansers chosen in this study are not expensive and are easily available in the market. On very first appointment maxillary dentures were cleansed with ultrasonic to create a uniform baseline as Abelson^[2] compared the ultrasonic technique with soak type tablets and found the former 2.5 times more effective. Patients were instructed for not removing and cleansing their dentures for 24 h before test session to allow building up of plaque. They were

allowed to rinse their dentures in water only, to prevent discomfort.^[5,7,8] As same person was supposed to come for five appointments so chances were there for drop out of patients so prior consent, proper explanation of study and good motivation to the patients was ensured. Many *in vivo* studies have advocated a gap of 3 days for adequate building up of plaque and to minimize overlapping effect of previous cleanser used.^[2,6,9,10] To overcome this bias, each denture was cleansed with all four cleanser and in different sequences in all four groups [Table 2]. Two tone dye solution was used to disclose the plaque for plaque scoring.^[9] Visual plaque scoring method was used as Sheen and Harrison reported that there is no significant difference between digital imaging and visual scoring method.^[11] Results also showed that there was no statistically significant change in plaque reduction ability of individual cleanser after changing the sequence of use. To avoid the observer bias, two clinicians (observers) were chosen and standardized. Maxillary denture was taken because of its large surface area. Only impression surface was included in this study, as tongue and cheek movements have cleansing action on polished surfaces and most of mucosal changes are because of plaque adhered on impression surface.^[12] During normal use of chemical cleansers, patients soak their dentures for overnight. To get the same action in short time we need to increase the temperature up to 45°C for 12 min^[4,5,7-10,13] and this temperature do not change properties of heat cure acrylic resin, so was safe. For toothpaste 15 mm length was taken as same was used by other authors.^[14-16] Liquid handwashing soap showed excellent cleansing equivalent to chemical cleansers but is not reported in literature. These mild soaps are harmless for denture surfaces, easily available and cost effective. Even plain water was able to reduce plaque because time given was 24 h between successive visits which is insufficient for organisation, calcification and firmly adhesion of plaque on denture surface. For organized plaque commercial denture cleansers are quite effective in reduction of microorganism which otherwise can cause oral manifestation if remain in contact with mucosa.^[17-19]

CONCLUSIONS

Brushing alone with a soft toothbrush and plain water could not clean the denture effectively so use of denture cleansers in mandatory. As toothpaste causes denture roughness with time so its use is not advised even though it is excellent cleanser. Chemical cleansers (either clinsodent powder or fittydent tablets) can be used for significant removal of accumulated denture plaque but adequate soaking time or recommended temperature is

needed for proper action which is not possible every time each day except night time. This study concludes that washing dentures with liquid handwashing soap after every meal or during day time is most convenient way followed by soaking dentures overnight in chemical cleansers. Even if patient is inaccessible to any of the cleansing product then for that situation washing thoroughly with plain water is also useful, but it should not be a routine practice. Further microbiological studies are needed to support these results.

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Conflicts of interest

There are no conflicts of interest.

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Kumar, *et al.*: A comparative study for plaque removing efficacy between commonly used denture cleansers

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