Evaluation of Four Different Denture Cleansers on Tea Stain Removal from Heat Cure Clear Acrylic Resin Specimens—An In Vivo Study

K. C. Uma1, K. M. Mathew1, P. Saji2, P. Shesha Reddy1, Ashish R. Jain1,*, A. S. Arthisri1

1Department of Prosthodontics, Asan Memorial Dental College and Hospitals, Chennai, India
2Department of Prosthodontics, Pariyaram Dental College and Hospitals, Pariyaram, Kannur, Kerala, India

Abstract

The rough and pitted surfaces seen on acrylic dentures act as niduses for biofilm formation and colonization of microorganisms. Denture cleaners are the most preferred for chemical cleansing, which has been suggested for the disinfection of prostheses. The aim of the study was to evaluate four different denture cleansers on tea stain removal from heat cure clear acrylic resins (DPI heat cure) material. Forty clean acrylic specimens of dimensions 40 mm × 20 mm × 1 mm were fabricated. The samples were then placed in fresh human unstimulated saliva for 2 min to form an initial pellicle layer and facilitate the uptake of stain, and they were washed with water. The samples were divided into 4 batches of 10 each. One-way ANOVA, Tukey’s HSD, and Students’ paired t-test were employed to identify the significant groups at 5% level. The mean value in Batch C, i.e., using Clinsodent powder (0.62 ± 0.32), was significantly higher than the mean values in Batch A, i.e., using Corega Bio Tabs (0.34 ± 0.14), Batch B, i.e., using fitty dent tabs (0.19 ± 0.19), and Batch D, i.e., using Steradent powder (0.25 ± 0.11) (p < 0.05). This study revealed that all the four immersion denture cleaners were effective in removing the tea stains from heat cure acrylic resins. Among the four cleaners, Clinsodent powder removed the tea stains to the greatest extent.

Keywords: Denture cleansers; Heat cure clear acrylic resin; Tea stain

Introduction

Complete dentures serve to replace missing or lost natural teeth and their associated structures to a great extent. Even then, they are only artificial substitutes and can be expected to simulate but not duplicate the natural teeth. It usually takes a few days to a few months for patients to get adapted to the new prostheses in the mouth. After this time, called the “adaptation period,” patients feel quite comfortable with the absence of natural teeth, and they must take care of their dentures [1,2]. Ideally, cleaning the dentures after every meal is advisable. Patients must be given clear instructions to immerse the dentures in water overnight; this has two advantages: (1) It gives relief from pressure over the denture-bearing area during sleep, and (2) it also helps to prevent warpage of the denture so that the fit/retention continues to be satisfactory [3-5]. At the time of insertion of complete dentures, the prosthodontist must clearly instruct the patient to clean the dentures daily, massage the denture-bearing area, use properly designed denture brush, etc.

Since most complete dentures nowadays are made with acrylic resin teeth with poly(methylmethacrylate) (PMMA) resin for the denture base, it is always better to follow a cleaning method in which strong abrasive action is not present [2,5]. Sensing this requirement, many commercial denture cleansers are currently available and each one claims to be efficient. A denture cleaner must be able to remove plaque and stain from the complete denture [1,5]. It must not abrade the denture, nor should it chemically react with it. It is also logical to expect a denture cleaner to have antibacterial and antifungal properties as it is to be used extraorally. Patients normally follow either one or both of the following methods of denture care: (1) use a soft denture brush with soap water and (2) immerse the complete denture overnight in denture cleansers.

While mechanical brushing with a denture brush and soap water can be easily expected to effectively remove plaque, debris, and stain, the same cannot be attributed to immersion cleansers [5-7]. The immersion cleaning method cited above does not cause abrasion on the complete denture. Although many studies have been conducted on many denture cleansers, a conclusion that a particular denture cleanser more effectively removes plaque and stain is yet to be arrived at [8,9].

Jagger and Harrison have done a study evaluating the efficacy of different denture cleansing materials in removing tea stains from heat cure acrylic resins. They found that many denture wearers may not be cleaning their dentures effectively. Their results showed alkaline hypochlorite had the highest ability for stain removal but they varied when they used roughened specimens [10]. Complete dentures are always provided to the patient only after thorough polishing. Hence, this study has been undertaken with specimens of highly polished surfaces. The present study has been undertaken to find out the relative efficacy of four different denture cleansers in removing tea stains on heat cure acrylic resin specimens, with the following objectives.

(1) To find out the ability of four different commercial brands of denture cleansers, i.e., Corega Bio Tabs, fitty dent tabs, Clinsodent powder, and Steradent powder, in removing tea stains from acrylic resins.

(2) To comparatively analyze the efficacy of the four different denture cleansers in removing tea stains from acrylic resins.
To quantitatively find out the differential ability of the four different denture cleansers in removing tea stains from acrylic resins.

Materials and Methods

This study evaluates four denture cleansers for their mode of action in tea stain removal from clear acrylic resin (DPI heat cure) material.

Equipment used

Spectrophotometer (uv–vis)

(Variancary 5E uv–vis spectrophotometer)

Materials used

Four denture cleansers

(1) Corega Bio Tabs (Stafford-Miller Ltd, Dungarvan, Co., Ireland)—Sodium bicarbonate, citric acid, potassium carbonate, sodium carbonate, sodium carbonate peroxide, tetra acetyl ethylene diamine, sodium benzoate, PEG 180, sodium lauryl sulfoacetate, subtilisin, PUP/VA copolymer, aroma CL73015, cl 42090.

(2) Fitty dent tabs (Group Pharmaceuticals Ltd.)—Sodium perborate monohydrate (480 mg)

(3) Clinsodent powder (ICPA Health Products Ltd.)—Sodium perborate (liberates nascent O2)

(4) Steradent powder (Reckitt & Colman Products Ltd)—Potassium monopersulfate, sodium lauryl sulfate, aroma, excipients

(5) Red Label Tea (Brooke Bond Tea Company)

To prepare the samples for the study, the dimensions of the sample holder were measured. Modeling wax sheet was used to prepare wax patterns of size 40 mm × 20 mm × 1 mm to fit into the sample holder. These wax patterns were flasked in dental flask with plaster of Paris. After wax elimination, packing was done with heat cure clear acrylic resin, and after trial closure, final closure was done. Bench curing was done for 30 mins and later standardized short curing cycle was followed. Following this method, 40 heat cure, clear acrylic samples were obtained. They were trimmed and polished through sandpapering using progressive grits of sandpaper, finally ensuring that the dimensions of 40 mm × 20 mm × 1 mm were maintained. Acrylic resin specimens (DPI heat cure clear acrylic resin) of 40 mm × 20 mm × 1 mm were prepared to fit in the specimen chamber of the spectrophotometer (variancary 5E uv–vis). The optical density of each of the samples was determined, then the samples were placed in the fresh human unstimulated saliva for 2 min to form an initial pellicle layer and facilitate the uptake of stain, and they were washed with water.

Spectrophotometric analysis was done to measure light absorbency of the specimens after staining with decoctions and subsequent to soaking 10 specimens each in each of the four denture cleansers.

Statistical Analysis

One-way ANOVA was used to calculate the p-value; Tukey’s HSD procedure was employed to identify the significant groups at 5% level. The comparison of each group was compared by Students’ paired t-test.

In the present study, p < 0.05 was considered as the level of significance.

Results

The mean value in Batch C (0.62 ± 0.32) is significantly higher than the mean values in Batch A (0.34 ± 0.14), Batch B (0.19 ± 0.19),
and Batch D (0.25 ± 0.11) \((p < 0.05)\). However, there is no significant difference in mean values between other contrasts \((p > 0.05)\). The percentage of UV ray absorption of the blank specimen (without stain) is 2.69%. After immersing the stained specimen in Corega Bio Tabs cleanser, the percentage of UV ray absorption was found to have a mean value of 2.88%. Likewise, it was 3.24% for fitty dent tablet, 2.73% for Clinsodent powder, and 3.13% for Steradent powder (Figures 1-4). The difference was found to be 0.19, 0.55, 0.04, and 0.44%, respectively, for each cleanser sample. Since the tea stain at a lambda maximum of 295 absorbed only 0.04% of UV rays, it was interpreted that the amount of tea stain present was very minimal to absorb the minimal amount of UV rays. So, as per study, Clinsodent powder showed maximum stain-removing efficiency. Corega Bio Tab was the second best. Fitty dent tablets and Steradent powder showed almost the same efficacy of stain removal (Figure 5).

**Discussion**

The increase in the usage of dentures has stimulated interest in controlling the deposited stains that normally collect on them. Fortunately, the modern denture has smoother surface texture and is less permeable than vulcanite and, as a result, is somewhat easier to keep clean. However, the use of artificial teeth with more natural contours and the trend toward stippled surface tend to provide more recessed areas for the accumulation of stains and debris and consequently increase patients’ cleaning problems [11].

A major cosmetic concern of denture wearers is the stains that accumulate on their dentures. These stains result from various processes, including ingesting colored food stuffs, smoking, and drinking beverages such as coffee and tea. Stains do not normally adhere directly to dentures but as biologic accretions that are similar to dental plaque [12]. This plaque may also be responsible for denture odor. When compared the oral hygiene of natural dentition with complete denture wearers, there has been less concern abpout contioned plaque control on surface containing oral mucosa. A common misconception among denture wearers is that dentures are exactly like having natural teeth. It is the duty of the prosthodontist to make sure that the patient is properly educated as to what wearing dentures will be like [5,13]. A patient who expects to be able to clean the denture as easily as he did with his natural teeth is going to be a disappointed patient.
If completely edentulous patients know how to look after their dentures properly, they are less likely to complain about staining, abrasion, or discoloration. If the cleaning process is easier, they are more likely to find their dentures an enhancement to their lives, rather than a hindrance. Denture cleanliness is essential to prevent malodor, poor aesthetics, and the accumulation of plaque or calculus with its deleterious effects on the mucosa. There are many types of solutions, pastes, and powders available for cleaning dentures, with a variety of claims for their relative efficacies [5,6,14].

The most common method of routine denture cleansing is brushing with tap water using either soap or toothpaste. Wear on dentures increases with the increasing diameter of bristles and decreases with increasing length of bristles [7,8]. Also, effective plaque removal requires a degree of manual dexterity that is often lacking, especially in geriatric patients who form the majority in wearing complete dentures. The use of chemical soaks is the second most popular method of denture cleaning. Chemical soaks have been extensively evaluated for their ability to remove food and stains from dentures. Chemicals used for denture cleaning are broadly divided into:

(I) Alkaline peroxides
(II) Alkaline hypochlorites
(III) Dilute acids (organic or inorganic)
(IV) Disinfectants
(V) Enzymes

The present study dealt with the evaluation of four different types of denture cleansers, namely, Corega Bio Tabs, fitty dent tabs, Steradent powder, and Clinsodent powder, for their ability to remove tea stains from clean acrylic specimens. The result revealed that Clinsodent powder was the most efficient in removing the stains from clear acrylic specimens, which is a peroxide type of denture cleanser. When dissolved in water, it forms a solution of hydrogen peroxide. This type of cleanser combines alkaline detergents to reduce surface tension and chemicals that release oxygen from the solution. The oxygen bubbles are supposed to exert a mechanical cleaning effect. This result is also in agreement with the views of David C. Abelson.3

Ultrasonic agitation is not the efficient method for the removal of denture plaque, since ultrasonic treatment per se does not cause a significant reduction in the removal of microorganisms that can be cultured from dentures. The American Dental Association (ADA) Council on Dental Materials Devices suggests that ultrasonic cleaners do enhance the cleaning capacity of detergent solution. They indicate, however, that the cleaning of the denture is related more to the chemical activity of the solutions than to the mechanical properties of the devices themselves.

Patients are routinely instructed to clean their dentures by light brushing with a soft denture brush or a multifluted soft nylon brush with rounded ends and soap and water. The mechanical cleaning action of the brush is usually sufficient to remove loosely attached soft food debris without abrading the denture base and teeth. However, it is ineffective for denture disinfection [9,10]. The removal of hard calculus deposits, plaque, and stains require more vigorous measures such as the daily use of impression chemical denture cleansers are brush-on diluted acid cleansers. The use of hard bristle brushes during forceful brushing and abrasive dentrifices such as a calcium carbonate are hydrated silica may cause abrasion of polymeric materials and result in scratches on their surfaces. The rough irregular surfaces promote the accumulation of denture deposits, increase in staining and fouling with oral microorganism, and their dramatically compromised denture esthetics [8]. Educating patients is crucial to enhance their awareness of both limitations and inherent weaknesses in their physical and mechanical properties of the inserted prosthesis. Furthermore, it must be emphasized that the improper care of dentures can have serious detrimental effects on the health of denture-supporting tissues. Most patients are unaware of the risks of microbial plaque accumulations around and under denture–tissue interfaces and are potential for promoting adverse pathological mucosal reactions such as denture stomatitis and angular cheilitis [3,7]. The presence of denture deposits and the rate of accumulations are directly related to the presence of a protein–rich saliva and the microporous nature of the polymeric base, which facilitates microbial plaque formation and ensures calculus deposition [15]. The organic portion of the calculus contains microproteins that bond the deposits of denture surface, whereas the inorganic portion mostly contains calcium phosphate and calcium carbonate. The maintenance of adequate denture hygiene through both mechanical and chemical methods is essential to minimize and preferably eliminate adverse tissue reactions. It must be an integral component of postinsertion patient care. Immersion cleansers, as indicated by the result of the present study, are effective in removing tea stains from heat cure acrylic resins.

Conclusion

This study revealed that all the four immersion denture cleansers were effective in removing tea stains from heat cure acrylic resins. Among the four cleansers, Clinsodent powder removed tea stains to the greatest extent. The second maximum tea stain removal efficacy was shown by Corega Bio Tabs. Fittydent tabs and Steradent powder showed almost the same efficacy of tea stain removal from heat cure clean acrylic resin specimens.

References

