

RESEARCH AND EDUCATION

Dental health professional recommendation and consumer habits in denture cleansing

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Regular cleaning of dentures is recognized as an important part of oral hygiene for denture wearers. Dentures predispose the wearer to denture stomatitis,¹ and microorganisms, including potential pathogens,² can be harbored on dentures. Ineffective denture cleaning may also lead to esthetic problems such as staining or bad breath. Denture wearers often suffer from the anxiety of further oral care problems. Furthermore, denture wearers fear that the esthetic problems of denture malodor and staining may reveal denture wearing to others (data on file).

A number of studies have evaluated typical methods used by denture wearers to clean dentures. These have generally found quite a range of methods, with brushing and use of water and toothpaste being commonplace.³⁻⁵ Another study related awareness of denture cleaning to socioeconomic status and disease,⁶ while variations were

ABSTRACT

Statement of problem. Regular cleaning of dentures is essential to the oral and general health of denture wearers. Only limited systematic data are available on the recommendations that dental health care professionals (DHCPs) make to patients for denture cleaning. Data on denture wearers' cleaning regimens are also lacking.

Purpose. The purpose of this study was to provide data on recommendations that DHCPs make to patients for denture cleaning and on the cleaning regimens of denture wearers.

Material and methods. DHCPs (n=613), including dentists and hygienists, were surveyed in developed (Japan, USA, Italy) and developing (Brazil, India) countries. A questionnaire assessing a range of denture cleaning recommendations was used. The questions addressed products, frequency, how to use remedies, the suggested dilution and duration of cleansing treatment, the location of dentures while cleaning, and the reasoning behind the recommendation of particular products or modes of treatment. Denture cleansing methods and the routine of denture wearers in developed and developing countries were also surveyed with a questionnaire (n=2862) and a 1-week diary (n=1462).

Results. An average of more than 2 treatments was recommended by DHCPs. Specialist denture cleanser tablets, "regular" toothpaste, mouthwash, soap and water, denture paste, foam or liquid denture cleanser, and dishwashing detergents were most commonly recommended; other product recommendations included baking soda, vinegar, salt water, and bleach. More than 10% of DHCPs made no primary recommendation on cleaning. Denture tablets were more commonly recommended in developed countries, whereas toothpaste was the most common recommendation in developing countries. Denture wearers used products and methods similar to those recommended by DHCPs. Toothpaste, water, and mouthwash were used more frequently than denture tablets. More than 75% of denture wearers reported using denture cleanser tablets for more than 5 minutes, whereas soap and toothpaste were typically used for less than 2 minutes.

Conclusions. DHCP recommendations and denture wearer habits are diverse, with no consensus on the most appropriate denture cleaning methods. This reflects a lack of clear, systematic evidence upon which to base recommendations. (J Prosthet Dent 2015;■:■-■)

also found by sex, with women found to clean their dentures more than men.⁷ However, in general, a lack of

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Clinical Implications

Dental health care professionals make diverse recommendations on denture cleaning, with no consensus on the most appropriate denture cleaning methods. This reflects a lack of clear, systematic evidence upon which to base recommendations. As a result, denture wearers use a range of methods that lack evidence of efficacy to clean dentures.

knowledge was often found among patients,⁸ with a general understanding that “I should do something,” but with methods being variable.⁹ Often, patients reported never having been instructed by their dentists as to how to clean their dentures.¹⁰

Although the need for professional recommendations on appropriate denture cleaning is clear, little is available in the way of national or international guidelines for dental health care professionals (DHCPs) on the most appropriate, evidence-based methods of cleaning dentures effectively. A data collection exercise by a manufacturer of oral health care products (GlaxoSmithKline) showed that in 10 countries in Europe, North and South America, and Asia, the majority of professional bodies did not make specific recommendations on denture cleaning (data on file). When made, recommendations usually focused on the use of either brushes designed specifically for dentures or soft brushes. There was some mention of avoiding abrasives. While denture cleanser tablets were mentioned, a number of bodies recommended dishwashing soap or vinegar. Most web site information seemed not to be evidence-based. Furthermore, where recommendations were found, they were often too vague to help the consumer select a suitable product.

Many studies have looked at the efficacy of a range of cleaning products or methodologies, including those specifically designed for use with dentures. Other oral care products (toothpastes, mouthwashes) through to soaps, dishwashing liquids, and bleaches have also been studied. However, in terms of evaluating the relative merits of various denture cleaning regimens, few articles are mentioned in the scientific literature.^{11,12} As a result, the recommendations of professional bodies are relatively limited. For example, the American Dental Association (ADA) recommends not using toothpaste because it can be too harsh for cleaning dentures, although “some people use hand soap or mild dishwashing liquid to clean their dentures, both of which are acceptable. However, most household cleaners are too abrasive and should not be used for cleaning dentures” (<http://www.mouthhealthy.org/en/az-topics/d/dentures-partial>).

Relatively few studies are available on the recommendations made by DHCPs, although some authors

have noted the importance of recommendations, the lack of evidence and efficacy for different methods, and the likely relation to disease.¹¹ Other authors lamented the lack of evidence for particular treatments, while noting that more studies are needed.¹² One study correlated lack of instruction with the incidence of disease.¹³

The objectives of the present study were to survey the attitudes toward and recommendations for denture cleaning of DHCPs (including dentists, denturists, and hygienists) across 5 countries, including both “developed” and “developing” countries and to determine denture cleansing methods and routines that typical denture wearers adopt in developed and developing countries. In this way, the study aimed to provide a broad understanding of professional recommendations and consumer habits in denture care.

MATERIAL AND METHODS

Dental Health Care Professional (DHCP) study

Research was conducted in 5 countries: Japan, USA, Italy, Brazil, and India, interviewing a total of 613 DHCPs. The majority (386) of the sample were dentists, but the studies in Italy and the USA also included hygienists, and, in Brazil, denturists were also surveyed. Interviews took place from November 2013 to January 2014. These DHCPs answered survey questions assessing a range of denture cleansing recommendations: products, recommended frequency, how to use remedies, suggested dilution and duration of cleansing treatment, location of dentures while cleaning, and any brand recommendations. Specific reasons or reasoning behind the recommendation of particular products or modes of treatment were also surveyed.

Consumer survey

Research was conducted in 6 countries. These were the same 5 as for the DHCP survey (Japan, USA, Italy, Brazil, and India) plus China, interviewing a total of 2862 denture wearers. From this group, 1463 denture wearers completed a behavior diary. The diary measured actual (reported) usage data (occasion-level data). For example, the diary allowed each respondent to report multiple occasions for each method used over a week and within the same day. Only data with a respondent-level base of at least 75 is shown. Wearers of both complete and partial dental prostheses were surveyed. The data collected aimed to capture the variety of methods and remedies used and to examine actual routines that denture wearers go through to clean their dentures and the degree to which these correlated with the instructions of DHCPs. The questions related to the detail of routines were focused on 4 products (toothpaste, denture cleanser tablets, mouthwash, and soap and water) based on their popularity in previous pilot studies (data not shown). The

Table 1. DHCP recommendations for denture cleansing (multiple responses allowed)

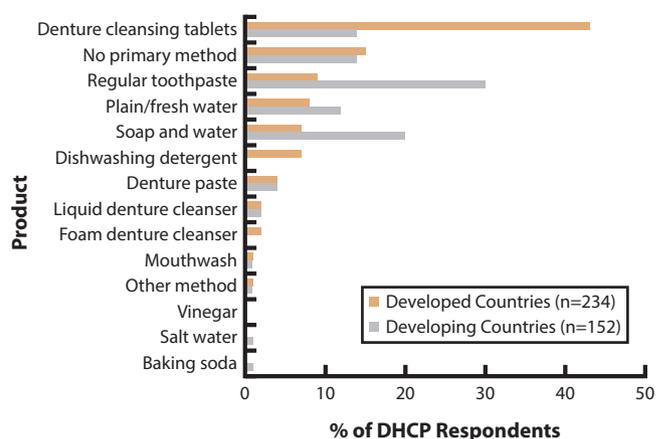
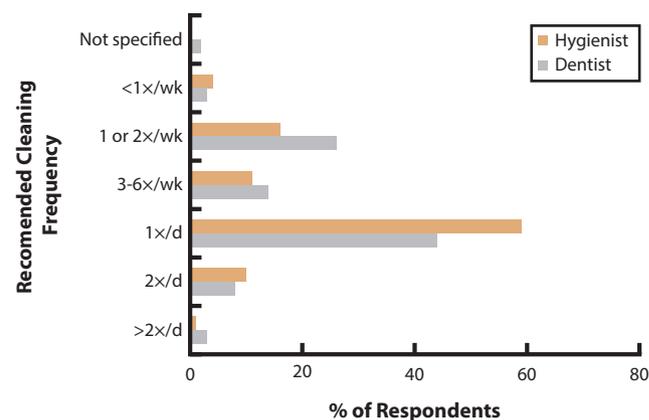
Product	Dentists (n=386)	Dental Hygienists (n=151)	Denturists (n=76)
Denture cleansing tablets	286	126	35
Regular toothpaste	114	27	54
Plain/fresh water	103	12	15
Soap and water	81	34	17
Special denture toothpaste	75	28	0
Liquid denture cleanser	45	19	0
Foam denture cleanser	39	17	0
Dishwashing detergent	38	24	1
Mouthwash	38	16	0
Baking soda	26	10	9
Vinegar	13	9	1
Salt water	9	4	1
Bleach	8	0	2
Other	8	15	0
Average No. of Products Recommended	2.3	2.3	1.8

diary survey specifically recruited denture wearers who followed DHCP recommendation and those who did not (thus the split between the groups is not an indication of the level of denture cleaning recommendation for the population as a whole). The diary study collected data on products used, frequency, mode of use (soak/brush/rinse), duration of usage, usage in or out of the mouth (for toothpaste and mouthwash only), order of soak/brush, and dilution (if any, for mouthwash only). The above information was collected across 7 different parts of the day.

RESULTS

Table 1 lists self-reported recommendations by dentists, hygienists, and denturists. A majority of all DHCPs recommended denture cleanser tablets. Additionally, many other methods were also commonly recommended, with regular toothpaste recommended by almost a third of DHCPs, fresh water by nearly a fifth, and soap and water by almost a quarter. There was also a considerable “tail” of other recommended methods, including denture paste, various liquid or foam denture cleansers, mouthwashes, and a range of “household” remedies, specifically dishwashing liquids, baking soda, vinegar, salt water, and bleach. On average, each DHCP recommended more than 2 methods to clean dentures.

Figure 1 shows the most important or primary method recommended by DHCPs, split into developing countries (Brazil, India), compared with developed countries (USA, Japan, Italy). While denture cleanser tablets were the most commonly recommended by some margin (Table 1), they were on average less than 50% in terms of primary recommendation across all DHCPs, and, among developing world DHCPs, were only recommended as the primary method by approximately 1 in

**Figure 1.** Primary denture cleaning recommendations of DHCPs in developing or developed countries.**Figure 2.** Dental health care professionals' recommendation on frequency of use of denture cleanser tablet. Dentists (n=286); hygienists (n=126).

7 DHCPs (14%) behind toothpaste (30%), and soap and water (20%). In developed countries, the denture tablet was the primary recommendation for 43% of DHCPs. Across all markets, a significant fraction of DHCPs (>14%) made no primary recommendation for particular products.

When the data were analyzed among dentists, hygienists, and denturists (denturists found in Brazil only) (data not shown), there were only modest differences between these DHCPs in terms of recommendation, with a slightly higher proportion of hygienists recommending denture tablets compared with dentists (83% versus 74%), while 71% of denturists more often recommended toothpaste compared with 18% of hygienists and 30% of dentists.

Figure 2 shows DHCP recommendations of frequency of denture cleanser tablet treatments. While 55% of dentists and 70% of hygienists recommend at least once daily treatments, 3% of dentists and 4% of hygienists recommend less than once weekly cleaning.

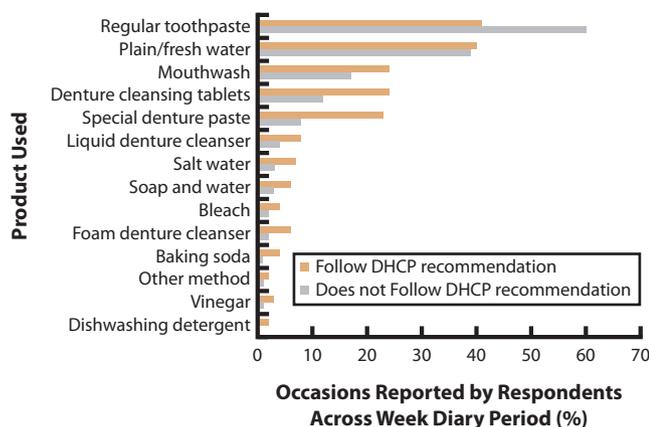


Figure 3. Denture wearer diary: percentage of occasions cleaning method was used (multiple responses allowed). Base sizes: Follow claimed recommendation (n=9372); No/did not follow recommendation (n=3260).

In terms of the detail of usage recommendations, toothpaste was most commonly recommended to brush dentures. Soap and water were also commonly recommended as brushing aids, although a number of DHCPs recommended soaking or cleaning with the hands. Fresh water was most commonly recommended as a rinsing or soaking method, rather than brushing, while mouthwash was most often recommended as a soaking treatment, typically diluted.

In the denture wearers' survey, 1463 denture wearers completed a denture care diary. Figure 3 shows the data for methods that denture wearers reported they had used as a percentage of occasions (respondents were allowed more than 1 choice), split between those who claimed to follow DHCP recommendations and those who did not. From these data, toothpastes were indicated as the most frequent method used by denture wearers, followed by fresh water and mouthwash. Denture tablet use was less frequent, with 24% usage during the week-long diary period among those following a DHCP recommendation. In contrast, only 12% of those denture wearers who did not follow DHCP guidance used denture cleansing tablets. A further 23% of occasions, among those following an alleged DHCP recommendation, were using denture cleansing toothpaste. Data on mouthwashes was more limited; however, Figure 3 shows 24% of those who followed DHCP recommendation used soaking, while 17% of those who did not follow DHCP recommendation typically swished with mouthwash in situ. Both DHCP recommendations and consumer habits, while the respondent numbers were small, indicated that mouthwashes were usually used in sharply varying dilution. DHCPs recommended at least 5 minutes of soaking in mouthwash, while denture wearers often only used mouthwash for 1 minute (data not shown). The frequency of mouthwash use was typically daily, both for

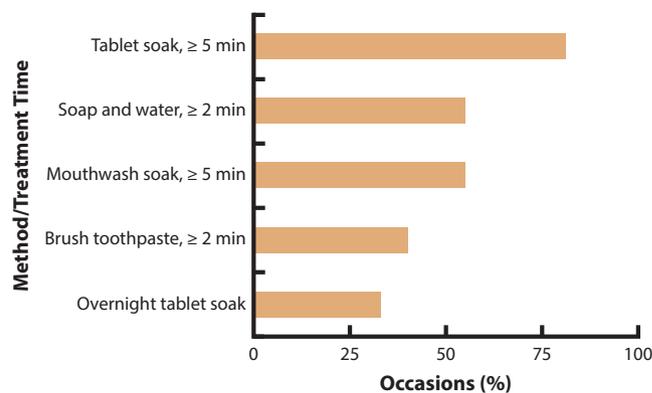


Figure 4. Denture wearer self-report of treatment times for most common products used. Base sizes: Overnight tablet soak (n=3223); Brush toothpaste ≥ 2 min (n=579); mouthwash soak ≥ 5 min (n=1176); soap and water ≥ 2 min (n=4882); tablet soak ≥ 5 min (n=3223).

DHCP recommendation and consumer diary self-report. Data for other treatments was still more limited, and thus usage patterns are not presented separately.

Similarly to the DHCP data (see Table 1), a significant "tail" of a range of household remedies was reported, including salt water, soap, bleach, vinegar, baking soda, and dishwashing liquids. The frequency of use of these household remedies was greater in the denture wearer's diary than in the DHCP recommendation survey.

In terms of duration of cleaning, a wide range of responses was noted from consumers. Figure 4 shows that denture cleanser tablets were typically used for soaking for more than 5 minutes (>75%), with a significant proportion of wearers soaking them overnight. In contrast, soap and toothpaste were typically used for much shorter periods, with only 40% of denture wearers using toothpaste and 55% using soap and water for 2 minutes or more.

DISCUSSION

The present study describes a detailed systematic survey covering both DHCP recommendation and patient behavior on denture cleansing regimens in several different countries. More than a dozen products were recommended by dentists, dental hygienists, and denturists. These ranged from products specifically designed for denture cleaning, such as denture cleanser tablets, denture foam products or liquid denture cleaners, oral care products (toothpaste, mouthwash), cleaning products (bleach, soap, dishwashing liquids), and kitchen ingredients (salt, vinegar, baking soda).

Denture cleansing tablets were most commonly recommended by dentists and hygienists, although denturists/prosthodontists in Brazil recommended toothpaste more often (data not shown). On average, more than 2 methods were recommended by DHCPs, with the primary recommendation showing a broad spread, with no method gaining more than 50% of dentist recommendations.

Toothpaste was more commonly the primary recommended method than cleanser tablets in developing countries, whereas in developed countries the position was reversed. Other methods, including plain/fresh water, soap and water, denture paste, liquid or foam cleansers, dishwashing detergent, and mouthwash, were recommended by more than 10% of the dentists or hygienists surveyed (Table 1). These other methods also featured prominently among primary recommendations, especially in developing countries. The proportions primarily recommending denture-specific cleansers, mouthwash, salt water, baking soda, vinegar, and dishwashing liquids were relatively low. Despite this wide range of recommendations, 1 in 7 DHCPs did not recommend any primary method, in line with most comparable published studies.¹¹⁻¹³

DHCP recommendations may reflect a lack of specificity from the professional bodies. Furthermore, while there were some geographical differences, no greater consistency in recommendations was found in one part of the world compared with another. As other studies have noted, this lack of consistency may also reflect the lack of sufficient systematic comparative data in the peer-reviewed literature for DHCPs to make evidence-based recommendations.¹² It may also reflect concerns among DHCPs and patients as to the costs of denture-specific products¹⁴ and may predispose DHCPs to recommend readily available home remedies. Often, however, no clear recommendation was made, or there was a lack of actionable identification of products or methods. For example, for denture cleansing tablets, 12% of DHCPs did not specify soaking or brushing. Of DHCPs who recommended cleaning with toothpaste, 32% did not specify quantity, and of the dentists recommending cleaning with soap and water, 7% did not describe how it should be done. This leads to patients making their own interpretations and is consistent with the on-pack directions for how to use products. For mouthwash, regardless of the recommendations, patients appear to follow the product instructions. Nonspecific denture cleaning products do not give suitable and effective directions for cleaning a denture, and may compromise the integrity of the appliance. When recommendations were made, consumer cleaning behaviors were closely matched to these (compare Table 1 with Figure 3). However, consumers reported using toothpaste more commonly than DHCP recommendations, and cleanser tablets were less used than fresh water in denture wearer reports. While no dramatic differences were found in the cleansing regimen reports of consumers who claimed to follow DHCP guidance and those who did not have any DHCP recommendation, there were differences. Those who did follow DHCP guidance used mouthwash or denture cleansing tablets or paste more commonly and toothpaste less frequently than those who did not receive or follow DHCP suggestions.

The length of time the products were used is also interesting (Fig. 4). Denture cleanser tablets and mouthwashes were commonly used for prolonged soaking (≥ 5 minutes) compared with toothpaste or soap/water (typically < 2 minutes). These findings have important implications for efficacy in all 3 dimensions of the denture cleansing triangle: simple cleaning, material compatibility, and antimicrobial efficacy. The effects of treatment times on antimicrobial and cleaning efficacy and material compatibility are discussed in greater detail in the paper by Kiesow et al.¹⁵

In terms of the pros and cons of particular treatments, specialist products such as tablets or cleansing pastes or foams are designed for use with dentures and often make a number of claims. For bacterial kill, claims such as "99.9% kill" are usually based on standardized antimicrobial assays, using appropriate microbial species. Cleaning claims are based on a range of specific *in vitro* methods. In contrast, although some household products (bleach, some hand soaps, dishwashing liquids) make antimicrobial claims, these claims are based more on intended usage patterns (bathroom, toilet, handwashing).

Toothpastes are also widely used and are clearly convenient and relatively inexpensive. However, they are designed to clean tooth surfaces and contain abrasives. Teeth are much harder than denture acrylic resin, and a recent study has shown how such abrasives can scratch denture acrylic resin,¹⁶ which may subsequently be more prone to microbial colonization. Further data on abrasivity is also presented in the paper by Kiesow et al.¹⁵ Many toothpastes contain ingredients such as triclosan, stannous fluoride, zinc salts or other antimicrobials, together with other ingredients, such as sodium lauryl (dodecyl) sulfate, added as a surfactant/cleaning agent, which may also have secondary antimicrobial effects. Furthermore, toothpastes are not generally designed for overtly antimicrobial activity, in that the key benefits of such products rest mainly on fluoride delivery as an anticaries active,¹⁷ together with mechanically aided cleaning for plaque removal and gingivitis benefits.¹⁸

Denture cleansing tablets, by contrast, are specifically designed to deliver direct antimicrobial action, often carrying claims based on percentage kill of oral microorganisms over specific time periods. The antimicrobial action of cleansing tablets is typically based on the generation of hydrogen peroxide, peracetic acid, and a range of oxygen radicals. They also usually contain surfactants to aid cleaning but do not typically contain abrasive agents.

The range of other methods reported both in DHCP recommendations and consumer behavior is surprisingly wide and reflects the lack of an evidence base and the consequent lack of consensus on denture cleansing methods.¹² While some data are available on the antimicrobial actions of some household products, the

data are not usually on denture-relevant microorganisms. The present study provides evidence that there is no consensus on denture cleansing recommendations among DHCPs and that this is reflected in consumer cleaning habits. There is a “Catch-22,” that is, DHCPs do not make recommendations because of lack of guidance from their professional bodies and the professional bodies are not able to give guidance to DCHPs because of lack of evidence-based published research. A wide range of products and routines are used for cleaning dentures across both developed and developing countries.

CONCLUSIONS

The need for a systematic comparison of the antimicrobial effects and material compatibility of methods used to clean dentures has been identified. Such data can be used to build an evidence-based consensus among DHCPs as to how consumers can maintain the cleanliness of their dentures.

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