Assessment of Additional Relative Plaque Removing Efficacy of a Newly Available Toothbrush

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Abstract

Aim: To confirm claimed additional efficacy of Sensodyne Expert toothbrush over other commonly used commercially available toothbrushes. Methods and Materials: This was a single use randomized double blind study for the assessment of plaque remaining after tooth brushing with Sensodyne Expert toothbrush to that remaining after brushing with the. Forty subjects were enrolled in the study. Only the right-handed subjects were chosen for the study. One side of the subjects’ oral cavity was randomly assigned to be brushed with Sensodyne Expert toothbrush while the other was brushed using the already in use subject’s regular toothbrush for one minute each side. Two tone disclosing agent was then used to identify and score post-brushing plaque remaining after tooth brushing on the selected teeth. Plaque was scored using the Turesky et al. Modified Quigley-Hein Plaque Index (TQHP1) on selected teeth on both sides of the oral cavity. Results: The mean post brushing plaque score for assessed teeth brushed with Sensodyne Expert toothbrush was 1.283 ± 0.39, while that with already in use subject’s regular toothbrush was 1.153 ± 0.71. Student t-test was used for analysis of results. There was an nonsignificant difference in post brushing plaque scores of both groups at assessed p value (P = 0.078). This suggests that subjects of this study were able to equally effectively remove plaque using their own and Sensodyne Expert toothbrushes. Conclusion: The plaque removing efficacy of Sensodyne Expert toothbrush was comparable to that of other toothbrushes when plaque on the selected teeth remaining after tooth brushing was assessed. Additional plaque removing efficacy of Sensodyne Expert toothbrush over subjects’ other already in use toothbrushes was not found.

Keywords: Additional plaque removing efficacy, dental plaque, manual toothbrush, oral hygiene

INTRODUCTION

Plaque control has become the cornerstone of periodontal therapy. Good oral hygiene is essential for preventing dental caries and plaque-induced/associated periodontal diseases, for, gingivitis, periodontitis, etc. It is well acknowledged that effective daily removal of plaque biofilm plays a very important role in maintaining oral health. The pivotal study of Loe et al. clearly showed that gingival inflammation consistently follows buildup of dental plaque and removal of plaque can reverse the process. This study clearly demonstrated not only the role of plaque in the development of plaque-induced/associated periodontal diseases but also that mechanical plaque removal by oral hygiene practices can reverse these inflammatory changes.

Of all the oral hygiene methods available, tooth brushing is one of the most commonly used. It is one of the most preferred methods of mechanical plaque control due to its effectiveness, convenience, and cost. Toothbrush is therefore considered to be an important tool in the long-term maintenance of periodontal health. The manual toothbrush is often the sole means of plaque control for many people. However, there is evidence that the individuals do not produce adequate reduction in plaque scores due to use of suboptimal brushing technique and brushing time. Manual toothbrush users also need to ensure that their chosen brush and their personal technique removes plaque successfully and efficiently from all tooth surfaces. Improvements in the method of toothbrushing and toothbrush design are therefore being continuously researched and “better” designs implemented throughout the world. Manufacturers of toothbrushes aim for innovations in features of toothbrushes that will help to compensate for suboptimal brushing technique and brushing time (Beals et al.). Designs of toothbrushing and toothbrush design are therefore being continuously researched and “better” designs implemented throughout the world. Manufacturers of toothbrushes aim for innovations in features of toothbrushes that will help to compensate for suboptimal brushing technique and brushing time (Beals et al.).

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today’s manual brushes have major innovations that make them very different from their older predecessors. Different designs of toothbrush filaments, head and the handle of a toothbrush are finalized after extensive research. Recent improvements in toothbrush include changes in size, design and flexibility of head, handle, and type of bristles. Recently, brushes with radical changes in their bristles including material of which bristles are made, their flexibility, diameter, varying diameter of each bristle along its length, stiffness, number of tufts, number of bristles in each tuft, relative lengths of each tuft, etc., have become commercially available. Understandably, toothbrushes with these special additional novel and often patented features are marked to be sold at a higher price. Manufacturers of such toothbrushes also justify higher selling price of the toothbrush due to higher quality of material to make the brush. This includes the material of the bristles, their length and varying diameter. Many recently available toothbrushes are more expensive than several other available in the market. It is a common experience that individuals tend to select and then change old toothbrushes based not only on professional recommendation but also on look, feel, and cost of the new toothbrush. Of individuals who do buy these relatively more expensive tooth brushes due to their special features many may not be able to easily afford them or rather would be more comfortable buying a cheaper but equally effective toothbrush. In other words, most individuals may not buy such “premium” toothbrushes if it is known to them that such premium toothbrushes ultimately remove plaque as effectively as their old less expensive toothbrush. Therefore, it is quite understandable that to have more people of the lower income groups use a toothbrush for maintaining their oral hygiene; a toothbrush must not only be efficient in removing plaque but also be priced low so that it is affordable by masses.

As design and cost of a manual toothbrush are important factors in deciding the selection of the toothbrush at the time of its purchase, it is important to assess their manufacturer’s claims of “additional plaque removal efficacy” of newer models of manual toothbrushes. If indeed, as claimed, the newer toothbrushes are more efficient in removing plaque, it would then make more sense in recommending these to our patients. If at all these newer models are priced higher than the more economical models, their small additional cost can be easily offset by huge benefits to oral and systemic health that come from better plaque control possible with such newer models. It is therefore not surprising that numerous studies have been and are carried out to compare the relative benefits of different manual toothbrushes around the world.

One such toothbrush marketed by the tradename of Sensodyne Expert toothbrush has recently become available. This toothbrush is available at MRP of Indian Rupees 90/- in the retail market. The manufacturer claims superiority of this toothbrush as it can provide effective cleaning of teeth in hard-to-reach areas due to its cross active, very fine bristles tips that are up to ×20 slimmer than other toothbrushes. The present study was designed to assess the manufacturer’s claimed superiority of Sensodyne Expert toothbrush over subjects’ other already in use regular manual toothbrushes.

Materials and Methods

Students of B.J.S. Dental College were invited to participate in the study. Participants enrolled for the study were asked to bring with them their routinely used toothbrush and dentifrice and report to the Department of Periodontology of the institution for assessment at 11 am on the selected day of making the assessment. They were instructed to follow their normal oral hygiene routines including tooth brushing, flossing, etc., one night before but thereafter refrain from all instituted oral hygiene procedures for not <12 h before this assessment. Participants were also asked to follow their normal meal routines, that is, they were not asked to modify their eating habits, meal timings, choice of food, etc. All participants were not aware of the goals and methodology of the study before or after completion of the study.

On the day of assessment, participants of the study were filtered, and forty were finally selected for the study according to inclusion and exclusion criteria. Inclusion criteria of participants: (1) Right-handed participants who brushed only with their right hands, (2) presence of 28 healthy natural teeth excluding third molars, and (3) systematically healthy individuals. Exclusion criteria of participants: (1) Currently participating in any other clinical trial or study; (2) taking any sort of medication for any reason; (3) known sensitivity/allergy to any dentifrice; (4) already using Sensodyne Expert toothbrush for toothbrushing; (5) any soft-tissue injury, gingival abrasion, or ulceration in the oral cavity; and (6) Ongoing orthodontic treatment.

In the department of periodontology, all forty participants who were selected for this study were handed over a brand new Sensodyne Expert toothbrush. Half of the participants (20) were instructed to brush their teeth on their right side with Sensodyne expert toothbrush and their teeth on their left side with their already in use old toothbrush for 1 min each side. The other half of the participants (20) were asked to do the vice versa. Participants were not given any special instructions regarding method of toothbrushing, that is, they were asked to brush their teeth in the manner they routinely did. All participants were also asked to apply an equal amount of their routinely used dentifrice on both their toothbrushes, that is, Sensodyne Expert toothbrush and their already in use old toothbrush.

Each participant was then asked to brush on the right side of their oral cavity for 1 min only using either their already in use toothbrush or Sensodyne Expert toothbrush as the case may be. After completion of 1 min of toothbrushing, they were asked to spit out the toothpaste foam, apply some more dentifrice to their toothbrush and then switch over to their left side for toothbrushing their teeth on that side, that is, total toothbrushing time for all teeth on both right and left sides was 2 min. After completion of the toothbrushing, participants were made to rinse their mouths thoroughly with water. Immediately
thereafter, a two-tone plaque staining solution was then applied to all teeth for 1 min; the staining solution was then rinsed out with water. A single examiner, who did not know the group splitting criteria, then scored stained plaque on all teeth being assessed within 5 min of plaque staining using the Turesky et al. Modified Quigley–Hein Plaque Index.\cite{10,11}

Buccal and lingual surfaces of three teeth, namely, lateral incisors, first premolars, and first molars of all quadrants were assessed for the remaining plaque on these after tooth brushing. Using the criteria of scoring of Quigley–Hein Index [Table 1], a score of 0–5 was assigned to each surface of the teeth being assessed in this study.

After completion of scoring, data were compiled into two groups. Group A comprised totaled plaque scores of all teeth of all patients of both groups that were brushed with already in use participant’s toothbrush. Group B comprised totaled plaque scores of all teeth of all patients of both groups that were brushed with Sensodyne Expert toothbrush.

**Statistical analysis**

Data were entered on to Microsoft Excel and statistically analyzed using Student’s t-test to assess the intergroup comparison of postbrushing plaque index values. A $P < 0.05$ was considered to be statistically significant.

**RESULTS**

Forty students participated in the study. No adverse effects or oral soft-tissue injuries were reported by any of the participants or the examiner assessing the participants. The mean postbrushing plaque index score of Group A and Group B are shown in Table 2.

The mean plaque index score of Group A was 1.283 ± 0.39 and that of Group B was 1.153 ± 0.71. Although the mean plaque index score of Group A was found to be higher in Group B, the result was found to be statistically nonsignificant ($P = 0.07$) as $P$ value has been found to be higher than 0.05.

**DISCUSSION**

Toothbrushing is one of the most commonly recommended and performed method of maintaining oral hygiene. Many models of manual toothbrushes are available in the market. In an effort to produce better plaque control and compensate for often, inefficient personal brushing technique and suboptimal tooth brushing time, toothbrushes are being constantly redesigned and remodeled. Manufacturers invest a lot of money to produce and market relatively more effective newer designs and materials of toothbrushes. Understandably, many newer models of toothbrushes are more expensive than other contemporary toothbrush models and make of toothbrushes.

As far as physical removal of plaque from oral surfaces is concerned, despite irrefutable evidence of superiority of manual toothbrushing over other methods of physical plaque control, many people consider a toothbrush and dentifrice to be an “unnecessary” luxury. This belief may also be due to several other socioeconomic and cultural reasons. Cost of a toothbrush and dentifrice may not be affordable by many households, and these therefore become important factors in maintaining these beliefs and habits. Although this may be, especially true in the developing world, it is also not an uncommon belief in developed world countries also. It is a common finding that a large population of India and such like countries depend on the more traditional methods of cleaning their oral cavities, for example, twigs/small thin branches of medicinal plants - “datun.” Use of such “datuns” has been an age-old practice and is strongly prescribed in parallel systems of medicine (Ayurveda, Unani, etc., systems).

It may be difficult to convince an individual who is accustomed to using datuns, which are practically free and use of which are commonly encouraged and prescribed by practitioners of alternate systems of medicine (vaids, hakims, etc.) to buy a toothbrush and dentifrice. Cost of a toothbrush may also be a major limiting factor in such an individual’s decisions of choice of buying or not buying a toothbrush and dentifrice. It is common experience that, after counseling, some such individuals can be convinced about the “extra” benefits of using a toothbrush for physical removal of plaque from oral surfaces. Such convinced individuals then may be ready to buy a toothbrush for cleaning their oral cavities. As a direct consequence of an individuals’ buying capacity, he/she may then be tempted to buy the most economical toothbrush or may actually buy a premium toothbrush at a price that he/she can hardly afford.

However, if the most economical toothbrush does not have design features to compensate for individual dependent factors affecting physical removal of plaque, the purpose of buying and using a toothbrush is left unfulfilled. On the other hand, if a more expensive toothbrush, that is, one with special design features or special bristles can relatively more effectively
clean the oral cavity by compensating for operator errors or facilitating the operator to produce more effective plaque control, the higher cost of such a toothbrush is easily offset by the huge benefits attained by such more effective toothbrushing. The vice versa may also be true.

Moreover, brushes that are commercially available have hard, medium, or soft bristles. Although all such toothbrushes will remove plaque, hard bristles can remove plaque better. Hard bristles, on the other hand, have a tendency of producing soft and hard tissue injury and irreversible damage. On the other hand, a soft-bristled brush may not be as effective as a hard-bristled toothbrush but if used properly is also effective in removing plaque. As softer bristles are more flexible they result in less if any harm to soft and hard tissues. Soft bristles may hold toothpaste better than hard bristles both in terms of quantity and duration. Medium toothbrushes are placed in between the two. Soft-bristled toothbrushes need more frequent replacement as their filaments tend to wear out and deshape relatively faster.

Recently, one such specially designed toothbrush, namely: Sensodyne expert toothbrush with “cross active” extra slim bristles has become available in the market. The manufacturer claims that the bristles of the toothbrush have very slim bristles. It is claimed that these very slim bristles being thinner than those of other commercially toothbrushes can perform cleaning of the hard to reach areas more effectively. Furthermore, these bristles being rounded, they produce less soft-tissue trauma and hard tissue abrasion.

It has been shown that rounded bristles cause 30%–50% less soft-tissue trauma than coarse-cut bristles and are superior in plaque removal, whereas the tips of coarse-cut bristles have sharp corners that reduce their cleaning efficiency and increases damage to the oral tissue. A hard-bristled brush has been shown to cause 3–6 times more abrasion than soft-bristled brushes. It has also been claimed that soft bristles are more flexible and thus can reach small crevices and proximal areas more easily. Most premium brushes have round bristles.

Although several workshops and reviews have consistently concluded that there is no superior design of manual toothbrush, different companies are coming out with different designs, each claiming superiority, backed by the results of their own clinical research team. Such conflicting claims of well-known companies and “loud” extensive advertisement of such claims influences individuals’ choice of purchase of toothbrushes. Such influenced individuals in their zeal and desire to produce better plaque control, and thus excellent oral health leading to maintenance of teeth in a healthy state or maintaining already diseased teeth and gums may develop a tendency to believe that newer and more expensive models of toothbrushes may be better suited for them. This may lead to “forced” purchase of more expensive toothbrushes by individuals who may not be able to afford these. If indeed all toothbrushes can produce similar plaque control, such influenced purchases of more expensive toothbrushes may not only be unjustified but also be a waste of precious resources of economically poor individuals. Claims of manufacturers of premium toothbrushes must, therefore, be tested through unbiased and independent studies.

Single-use comparative clinical studies are useful for determining the relative plaque removal effectiveness of toothbrushes and may provide an indication of gingival health benefits in long-term. Many factors such as duration of toothbrushing; manual dexterity, motivation, the frequency of toothbrushing, and the novelty effect can influence results of such studies. Keeping these in mind, this study was designed to test the claims of superior cleaning efficacy of one such “premium” toothbrush, that is, Sensodyne expert toothbrush over other toothbrushes that individuals were already using.

Forty participants who met the inclusion and exclusion criteria were enrolled in the study for assessing the plaque removing capacity of both Sensodyne Expert toothbrush and the already in use participant’s regular toothbrush by assessing the postbrushing plaque remaining after toothbrushing. It was found that mean postbrushing plaque score for assessed teeth brushed with Sensodyne Expert toothbrush was 1.283 ± 0.39, while that with already in use participant’s regular toothbrush was 1.153 ± 0.71. The results were then statistically analyzed using Student’s t-test. It was there after found that there was a nonsignificant difference in postbrushing plaque scores of teeth that were brushed with either the already in use participant’s regular toothbrush (Group A) or Sensodyne Expert toothbrush (Group B) at assessed P value (P = 0.078). This suggests that participants of this study were able to equally effectively remove plaque using their own and Sensodyne Expert toothbrushes. The results of present study are consistent with the study conducted by Beatty et al., 1990 who found no differences in plaque reduction between 0.18 and 0.2 mm bristle diameter.

It has also been previously shown that, when eight branded toothbrushes were compared for their effectiveness in removing plaque, none of the modifications in brush design facilitated plaque removal. Sripriya and Shaik Hyder Ali evaluated the efficacy of four most commonly used bristle designs of toothbrushes in plaque removal. The results of their clinical study indicated that all the toothbrushes reduced plaque scores significantly compared to the baseline scores, but there is no single superior design of manual toothbrush was found. In a single-blind, cross-over study, the performance of different toothbrush models for controlling plaque was compared. The three brushes were capable of efficiently removing plaque and the arrangement of the bristles had little effect over the removal of plaque. Bergenholtz et al., found no differences between space tufted and dense multi-tufted toothbrushes, between hard or soft bristles, or between short- or long-headed brushes in clinical plaque removal efficacy using the roll technique. The results of our study support the above findings.

Claims of superior plaque control after using Sensodyne Expert Toothbrush as claimed by manufacturer, when compared to that attainable by the already in use participant’s regular toothbrushes have not been validated by our study. In other words, as far as
physical removal of plaque is concerned, any toothbrush design has been shown to produce almost comparable results. It must be borne in mind that our study compared the already in use participant’s regular toothbrush, that is, old toothbrush with a brand new Sensodyne® Expert toothbrush. It is believed that plaque removing efficiency of toothbrushes decline with use. This may also be the case with Sensodyne® Expert toothbrush. The plaque removing capacity of an old Sensodyne® Expert toothbrush versus the already in use participant’s regular tooth, that is, old toothbrush still remains to be assessed.

If the results of this study are true, then individuals and prescribing health-care professionals may weigh out the cost versus benefits of such more expensive toothbrush models before buying or recommending these. Patients and other individuals may also be educated about these facts so that individuals may not shy away from toothbrushing as such just because they could not afford a premium toothbrush believing the cheaper toothbrushes are not effective and therefore not worth buying and using. If, however, an individual can be motivated to brush his/her teeth better and produce better plaque control believing that using a toothbrush with a newer design will produce better plaque control, then the higher cost of the toothbrush can be easily offset by gains in oral hygiene. Better and more efficient plaque control will also translate into reduced dental care costs and longevity of teeth for such individuals.

As this study was short-term and involved highly motivated participants (dental students), the results of this study may not be comparable to those that may be obtained if the same study was done using participants from the general population. Clinical trials on larger samples for longer periods may give a better picture of the effect of toothbrush bristle diameter, etc., on its plaque removal efficacy. Using this study, dental professionals and the general population may make more informed choices about different commercially available toothbrushes and their potential benefits.

**Conclusions**

The plaque removal efficacy of a new Sensodyne Expert toothbrush was found to be comparable to already in use participant’s old toothbrushes in this study. Although the mean plaque score of Sensodyne Expert toothbrush was found to be better than that of the other toothbrushes, the results were found to be statistically nonsignificant. Physical removal of plaque can be accomplished by any toothbrush. Based on the results of our study, stress should, therefore, be laid on brushing rather than a particular model or make of a toothbrush, though some models of toothbrush make brushing a more comfortable experience.

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**Conflicts of interest**

There are no conflicts of interest.

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