

Data Sheet no.4 in support of the Collis Curve Toothbrush

Improving quality and efficiency in dental hygiene

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Improving Quality and Efficiency in Oral Hygiene

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A large percentage of the residents in long-term care facilities are unable to achieve an acceptable level of oral hygiene due to mental and physical incapacity's and must thus rely on nursing staff for daily oral care. Moreover, a recent nationwide health survey by the National Institute of Dental Research indicates a tremendous decline in the number of adults who have lost all of their natural teeth. Since 1960, the rate of toothlessness has dropped 60% among 55- to 64- year olds. This, coupled with a shortage of nursing personnel and a rapidly increasing elderly population, is placing an increased burden on Institutions to provide more oral care for more individuals who become less able to care for themselves.

Proper toothbrushing to remove dental plaque is the most commonly recommended procedure for oral hygiene, and persons of all ages find acceptable plaque removal to be difficult and time consuming. However, its importance cannot be overlooked. Significant morbidity is associated with chronic inadequate oral hygiene. In addition, lack of self-esteem related to poor dental status has been observed in some nursing home patients, resulting in withdrawal from social interaction and eventually leading to personal isolation. 1.2

This study was designed to evaluate a toothbrush specifically designed for the dependent resident needing assistance in brushing. The goals were to further evaluate the Collis Curve brush in relation to efficiency of plaque removal and to attitudes of the nursing staff in using it for the oral hygiene for dependent residents.

Developed by George C Collis, DDS, the brush has two outer rows of soft bristles curved around a center row of short, stiff ones to snugly cover all surfaces of the teeth (Figure 1). As the brush is moved horizontally, the inner bristles clean the chewing surface while the outer bristles curve around to clean the sides and the gum line (Figure 2). This design minimizes position changes needed for effective brushing and improves ease of access to more obscured dental surfaces. Other significant benefits are reduction in time and degree of difficulty to achieve effective oral hygiene for the resident needing attendant brushing or for the physically impaired patient attempting self-brushing.

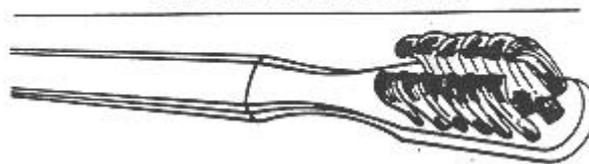
Original reports by the brush's developer claimed that adequate cleaning with the Collis Curve brush was accomplished in 30 seconds.³ Studies by Avey and Shory, Mitchell, and Jamison⁵ suggested a greater degree of plaque removal in comparison with a standard bristle brush, but they did not quantify times. Obviously, a marked reduction in the time required to perform adequate dental hygiene is expected to promote the nursing staff's ability to achieve, and an interest in accomplishing, acceptable levels of plaque control.

MATERIALS AND METHODS

This study involved 75 geriatric residents in two separate long-term care facilities. The residents selected by the nursing staff were volunteers and had a minimum of one arch of natural dentition (uppers or lowers). These residents were separated into two groups: self brushers and those needing assistance.

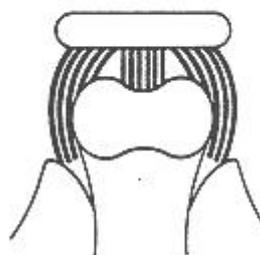
The curved bristle brush was compared with a conventional straight bristle brush to determine how well it removed plaque. Two types of curved bristle brushes were used: the regular adult brush and the periodontal model, which has outer bristles that are 3 mm longer than the regular adult's to reach sulci of recessed gums. Examiners determined which curved brush would be used by evaluating gingival recession (amount of exposed root). If the gingival margin was 2 mm apical to the cemental enamel junction (CEJ), the periodontal model was used. Third-year dental students determined brush selection and recorded the plaque scores.

**FIGURE 1
CURVED BRISTLE BRUSH**



Six specified teeth were examined in each resident: the maxillary right first molar; the maxillary left central incisor; the maxillary left first bicuspid; the mandibular left first molar; the mandibular right central incisor; and the mandibular right first bicuspid. When one of the specified teeth was missing, the tooth adjacent or distal to that specified was used. If there was no adjacent tooth, no score was given for that quadrant. AD erythrocin disclosing solution was applied with a cotton tip applicator to only those teeth to be checked for plaque. Each tooth was given a plaque score of 0 to 3: no evident plaque was scored as 0; one third of the tooth covered by plaque was scored as 1; two thirds of the tooth covered by plaque was scored as 2; and if the entire tooth was covered with plaque a score of 3 was recorded. Both the lingual and buccal (or facial) surfaces were given a plaque score for a total of 12 scores per resident per visit.

**FIGURE 2
BRISTLES BEING
APPLIED TO SURFACES
OF THE TOOTH**



The study was conducted over a five week period. The curved bristle brush and its method of brushing were induced to the nursing staff the first week. Because the brushing technique is different, a few days are required to break the habit of brushing with a straight bristle brush. Each of the nursing staff was given a curved bristle brush and asked to use it for her own oral hygiene for a week (week 1) prior to using it with dependent residents. The nurses were informed that the speed of assisted resident brushing with the curved bristle brush was being studied as well as the brush's ability to remove plaque. They were limited to one minute of brushing from the time the brush was picked up until it was rinsed and put away.

No toothpaste or other abrasive dentifrice was used in this study. This decision was made for two reasons. First, the author wanted to examine the brush design and bristle action of plaque removal and not complicate the study by an additional agent. Second, the author did not want the residents to feel the need to expectorate during the limited time used for brushing. The brushes were rinsed with mouthwash prior to brushing to help the residents feel refreshed.

On the first day of the second week, a baseline score was taken and the residents were introduced to the curved bristle brush. Plaque scores were recorded after using the curved bristle brush for four days of the second week. On four days during the third week, the plaque score was recorded for the same resident group after using a straight bristle brush. During the fourth and fifth weeks, the nursing staff continued to brush using the brush of their choosing. A follow-up score was recorded at the end of five weeks.

Of the original 75 residents selected for the study, only 22 were included in the analysis. This reduction is due to combination of factors, mainly that the examiners' only free time was in the evening. During this time, other patient needs as well as the workings of the institution prevented the examiners from observing brushing and recording plaque scores on all of the residents each evening. To be included in the analysis, a baseline plaque score and four plaque scores with both the curved bristle brush and the straight bristle brush were needed. Thirteen residents started out in the assisted brushing group and 9 in the self-brushing group. After the first observation of brushing, the examiners moved six of the self-brushers to the assisted group. The study then had 19 in the assisted group and 3 in the self-brushing group.

In addition to the plaque scores compiled from the residents, a questionnaire was given to 48 members of the nursing staff to determine their response to the curved bristle brush as compared with a straight bristle brush. The questionnaire was given at the end of the third week (after they had a chance to compare both brushes) and again at the end of the study to determine which brush was being used and if their attitudes had changed. Questions asked are shown in Figure 3. Staff were also encouraged to comment on the study or the brushes used.

**FIGURE 3
QUESTIONNAIRE AND RESPONSES**

1. Did you find the Collis Curve toothbrush easy to clamp on your client's teeth?		
• Yes	95%	100%
• No	5%	0%
2. The brush that was easier to manipulate in the client's mouth was:		
• The straight bristle brush	2%	0%
• The Collis Curve brush	76%	90%
• Both the same	22%	10%
3. The toothbrush you found to be less time consuming to use while brushing your client's teeth was:		
• The straight bristle brush	5%	0%
• The Callis Curve brush	76%	85%

• Both the same	19%	15%
4. You found your clients complained less while you were brushing their teeth when you used:		
• The straight bristle brush	8%	0%
• The Collis Curve brush	67%	10%
• Both the same	25%	90%
5. Your job of brushing your client's teeth was made easier when you were using:		
• The straight bristle brush	0%	0%
• The Collis Curve brush	73%	42%
• Both the same	27%	58%
Comments		
• Positive	54%	73%
• Negative	5%	0%
• No Comment	41%	27%

RESULTS

Mean plaque scores alter using the curved bristle brush when compared with the straight bristle brush differed significantly, but when comparing the deviations from the baseline the difference between plaque scores recorded for the two brushes were not statistically significant.

The curved bristle brush provided lower plaque scores than the straight bristle brush in all areas except the maxillary and mandibular facial. The lingual surfaces recorded the greatest differences, especially the posterior lingual..

The responses to the questionnaire given to the nursing staff are presented in Figure 3. In response to the first survey, after both curved and straight bristle brushes had been used, 95% said the curved bristle brush was easy to place on the teeth. On the second survey, given at the end of the project, 100% felt the brush was easy to place on the teeth.

As to the ease of manipulation, 76% felt the curved bristle brush was easier to manipulate, 2% felt the straight bristle brush easier, and 22% responded they were about the same. In the follow-up questionnaire, 90% felt the curved bristle brush easier and 10% felt the brushes to be about the same.

The third question was to obtain the nursing staff's subjective feeling regarding time needed for oral hygiene. On the first survey, 76% felt the curved bristle brush took less time, 5% felt the straight bristle brush took less time, and 19% felt them to be about the same. On the second questionnaire, 85% felt the curved bristle brush took less time and 15% felt them to be about the same.

Regarding nursing assessment of resident complaints during brush use, 67% noted fewer complaints with the curved bristle brush, 8% fewer complaints with the straight bristle brush, and 25% felt the response equivalent. By the end of the study, 90% felt they received as many complaints with one brush as they did with the other and 10% felt the curved bristle brush received fewer complaints.

Regarding ease of brushing residents teeth, the first survey showed 73% felt the curved bristle brush made the job of oral hygiene easier; 27% felt the brushes to be about the same. At the end of the study, 42% felt the curved bristle brush made the job easier and 58% felt the brushes to be about the same.

The first questionnaire contained 54% positive comments for the curved bristle brush, 5% negative comments, and 41% had no comment. The second survey had 73% positive comments, 0 negative comments, and 27% had no comment. Positive comments typically referred to ease of curved bristle brush use ("brush much easier to manipulate in mouth"). One of the two negative comments reflected a subjective feeling that the curved bristle brush was "too large."

DISCUSSION

The results of the study and the comments of the nursing staff and examiners raise several points for discussion. The examiners noticed a difference in the location of plaque remaining on the teeth after brushing with the two brushes. With the straight bristle brush, the remaining plaque tended to be at the gingival margin; with the curved bristle brush, it was on the occlusal third of the teeth surveyed. This observation high-lights the importance of a gingival index along with the plaque score for a study over a longer period. In a recent wudy⁵ conducted with school children, both the straight and curved bristle brush improved the gingival index, with more improvement to students who used the toothbrushes with curved bristles.

The greatest difference in scores for the two brushes are on the lingual surface of the posterior teeth. For the resident needing assistance brushing, this difference is expected. ~r the straight bristle brush to clean the posterior lingual surface it must be placed where it infringes on the tongue, increasing the gag reflex, complaints, and discomfort of the residents. Since the curved bristle brush, if properly used, does not infringe on the tongue space, this may explain why the nursing staff felt they had fewer complaints from the residents using the curved bristle brush .

A study by Banting found that the proportion of persons displaying root caries increased with advancing age , and the chronically ill and hospitalized patients tended to have the highest rate of root caries . Extensive root caries can require a very difficult restorative procedure. The increased cleanliness at the lingual gingival margin could, and should, mean a decrease in root caries for this area.

As mentioned above, the maxillary and mandibular facial areas had lower plaque scores with the straight bristle brush. After this observation was made, brushing instructions with the curved bristle brush were modified. After the brush is used as designed (clamped over the teeth), the curved portion was used as a straight bristle brush for the facial surface of the anterior teeth. With this simple modification, the curved bristle brush performed as well as the straight bristle brush on the facial surfaces.

As a result of the study, an improvement from the baseline occurred in the plaque score for both types of toothbrushes. The improvement shown by the straight bristle brush (24% for the posterior teeth and 52% for the anterior teeth) can be attributed to the study. The nurses' aides knew their brushing techniques were being monitored and thus provided more effective oral hygiene than they had prior to the study. The additional reduction in plaque score from the straight bristle brush (an improvement of 92% for the posterior teeth and 10% for the anterior teeth, when using the curved bristle brush) can be attributed to the design of the brush. With the modified brushing instructions mentioned earlier, an estimated improvement of 23% for the anterior teeth would occur.

The follow-up mean plaque score was not as low as during the study. but it was better than the baseline score. This difference of 0.568 (an improvement) i~ the mean plaque score over baseline may be due to the use of the curved bristle brush. A decline in mean plaque score of 0.455 from the

score during the study could be due to failure to monitor the brushing procedure prior to the follow-up score being taken. The importance of proper oral hygiene must be supported by nursing supervisors and monitored occasionally.

The difference in the initial number of residents placed in the self-brushing group and the number who were capable of self-brushing needs to be considered. The resident's willingness and interest in performing personal hygiene chores were encouraged by the nursing staff, and those residents who were willing to try brushing were initially placed in the self-brushing group. All others were placed in the assisted group. An established protocol may be needed to evaluate the ability of residents to perform personal oral hygiene. Based on guidelines, the nursing staff may need to give assistance to achieve acceptable levels of oral hygiene after the residents have done their best.

A more acceptable level of oral hygiene was achieved when the brushing was monitored for both the self brushers and those needing assistance. More frequent inservices on the importance of dental health and oral hygiene, for both residents and staff, may improve self-motivation in performing oral hygiene procedures. When establishing an acceptable oral hygiene level, one must not accept any less than the very best possible for each individual resident. A professional prophylaxis prior to this study would have benefited every resident and probably would have improved the plaque scores for both brushes. As long as a resident has teeth, whether natural or artificial, he or she will benefit from regular professional oral exams and prophylaxis. Poor oral health can be a major contributing factor to malnutrition, decreased vitality, facial disfigurement, and embarrassing social encounters. By setting mutual goals, the nursing supervisor and dentist can raise the level of health care. The prevention of additional and complicating illnesses can be enhanced with effective oral health practices, making the jobs of the staff, supervisors, administration, and other health professionals more enjoyable and rewarding.

One of the original criteria was the speed of brushing with the curved bristle brush. We were prepared to limit the brushing time to one minute, but that option was never used. The brushing times for this study are variable but are all under one minute. More diligent brushing for a minimum of one minute instead of a maximum of one minute would improve the plaque scores regardless of the brush used.

The last point of discussion compares the first three questions on the questionnaire with the last two. When looking at the first three questions, it is easy to see the vast majority felt the curved bristle brush was easy to place on the teeth, easy to manipulate within the mouth, and took less time to do the job. When looking at the last two questions, initially, the majority felt they received fewer complaints with the curved bristle brush and felt that it made the job easier. By the end of the study, the staff felt they were receiving as many complaints with one brush as the other, and those who thought the curved bristle brush made the job easier had fallen from 73% to 42%, with the others letting the brushes to be about the same with regard to ease of use.

As stated earlier, acceptable plaque removal is difficult, therefore, when 42% responded that the curved bristle brush made their job easier, it seemed clinically significant. Another significant factor is the 67% who felt they received fewer complaints with the curved bristle brush. The report of an equal number of complaints on the Second questionnaire may be the result of patients' attempts to gain attention through complaints. The residents receiving assistance with brushing were not informed as to which brush was being used. Therefore, the response from the first questionnaire, prior to the novelty of the study fading, may be the best indicator of the residents' feelings about the different brushes.

CONCLUSION

The curved bristle brush was well accepted and made the task of oral hygiene easier for the nursing staff. As for plaque removal, the curved bristle brush removed more plaque than the straight bristle

brush. Regardless of the brush used, the monitoring of oral hygiene procedures significantly improved plaque scores.

The curved bristle brush was also well received by the residents. This was probably because proper brushing could occur without the brushes infringing on the tongue or cheeks.

These results suggest that the curved bristle brush may be the recommended oral physiotherapy aid for the individual needing assistance with brushing. Institutions need to consider adoption of this toothbrush as a way to make the oral hygiene task easier for their nursing staff. Replication of this study over a longer period and with a larger number of residents is needed. The following recommendations may also be helpful:

- If, in additional studies, patient complaints are considered criteria for distinguishing actual complaints due to brushing from attempts to get attention are needed.
- The establishment of two or three consistent brushing times would help to compare not only the brushes but also the time needed for each brush to be effective.
- Examiners with flexible schedules would help make it possible to include more residents in a study.
- Another interesting area to study is the correlation between taste response and tongue brushing.

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