The Effect of Waxed and Unwaxed Dental Floss on Gingival Health

Part I. Plaque Removal and Gingival Response

David M. Lamberts,* Richard C. Wunderlich,† and Raul G. Caffesse‡

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THE PURPOSE of this study was to determine the effectiveness of waxed and unwaxed floss in plaque removal and on gingival health when used in a home oral hygiene program. Eighty patients, having previously received periodontal therapy, were divided into four similar groups, according to the S-OHI. Each group represented four different types of dental floss being tested: Butler waxed, Butler unwaxed, Johnson and Johnson waxed, and Johnson and Johnson unwaxed. After receiving a thorough prophylaxis, each patient received oral hygiene instruction with a video tape, and was given a toothbrush and a quantity of test floss. At 0, 28 and 56 day intervals, the patients were scored for plaque and gingivitis. The data were then analyzed statistically using analysis of variance. It was found that there was no statistical difference among the four different types of tested floss as far as their plaque removal ability or prevention of gingivitis is concerned.

Many investigators have shown that plaque removal will lead to the reduction in severity of gingivitis.[1-3] It appears that plaque removal by toothbrushing alone is incomplete,[2,4-6] and that gingivitis may be more severe interdentally.[2,3,7] Therefore, it seems that interdental aids should be an integral part of a regular oral hygiene regimen. Although some investigators found no differences between the cleaning efficiency of waxed and unwaxed floss,[8-10] Carter and coworkers[5] found that gingival bleeding was reduced faster with unwaxed floss than with waxed floss. Bergenholtz and Britton[11] also noted a slight tendency for unwaxed floss to be more effective than waxed floss for plaque removal. The purpose of this study was to determine the effectiveness of waxed and unwaxed floss in plaque removal when used in a home oral hygiene program.

MATERIALS AND METHODS

Eighty volunteers were selected from a pool of patients who had previously received periodontal treatment and who were now on maintenance recall at The University of Michigan, School of Dentistry. There were 15 males and 29 females with ages ranging from 22 to 79 years. The mean age was 38.8 years. The subjects represented a range of oral hygiene status[12] from 0.17 to 2.00.

All patients were required to have the six teeth proposed by Ramfjord[13] (#3, 9, 12, 19, 25, 28) contacting adjacent teeth. Patients were excluded if there were defective or overcontoured restorations, temporary restorations, or orthodontic bands on or near the selected teeth. Opposing dentition was mandatory for all teeth selected. In addition, patients scheduled for operative dentistry on or near the test teeth were excluded.

Initial Scoring Method. Prior to an initial prophylaxis, each patient was scored according to the criteria of the Simplified Oral Hygiene Index (S-OHI),[12] with slight modification in tooth selection. Oral debris and calculus indices were calculated and combined to obtain the S-OHI. Buccal surfaces of teeth No. 3 and 14 and the lingual surfaces of No. 19, 24, 25 and 30 were scored for debris and calculus.

The following scoring system was used:

Oral Debris

0—No debris or stain present.

1—Soft debris covering not more than one-third of the tooth surface being examined or the presence of extrinsic stains without debris, regardless of surface area covered.

2—Soft debris covering more than one-third but

* Present address: 2330 44th Street, S. E., Grand Rapids, MI 49508.

† Assistant Professor, The University of Michigan School of Dentistry, Department of Periodontics, Ann Arbor, MI 48109.

‡ Professor and Chairman, Department of Periodontics, The University of Michigan, School of Dentistry, Ann Arbor, MI 48109.

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not more than two-thirds of the exposed tooth surface.

3—Soft debris covering more than two-thirds of the exposed tooth surface.

Oral Calculus

0—No calculus present.

1—Supragingival calculus covering more than one-third of the exposed tooth surface being examined.

2—Supragingival calculus covering more than one-third but not more than two-thirds of the exposed tooth surface, or the presence of individual flecks of subgingival calculus around the cervical portion of the tooth.

3—Supragingival calculus covering more than two-thirds of the exposed tooth surface or a continuous heavy band of subgingival calculus around the cervical portion of the tooth.

After the above scores were recorded, the total scores for each individual was divided by the number of surfaces scored. The result constituted the S-OHI for that particular individual.

Formation of Groups. The 80 subjects were divided into four groups of 20 patients. Attempts were made to distribute the patients equally according to S-OHI status. This was done in an attempt to distribute those with good oral hygiene and poor oral hygiene so that this aspect would be a controlled variable. Patients were randomly assigned to groups by S-OHI score rather than by name or gender. Each group used their designated floss for the entire 56 days for the experimental period.

Group I	Butler unwaxed
Group II	Butler waxed
Group III	Johnson and Johnson unwaxed
Group IV	Johnson and Johnson waxed

Each patient received a soft "multitufted" brush and the appropriate floss. Fifty-yard containers of waxed (Butler Bit-O-Wax)* or unwaxed (Butler Right-Kind),* (or three, 12 yard containers of waxed (Johnson and Johnson)† or unwaxed (Johnson and Johnson)† dental floss were given to each patient in the appropriate group. Supplemental floss was available at the recall appointments.

Audiovisual Material. Standardization of oral hygiene instruction was achieved by use of an edited color audiovisual oral hygiene tape‡ shown individually to each patient in the Caident Center, School of Dentistry, The University of Michigan. Although the patients had received oral hygiene instructions during their periodontal therapy, it was felt that use of the tape would insure uniformity in instruction. Questions were encouraged and instruction was given when requested. Oral hygiene instruction was limited to the initial appointment.

Evaluation Criteria. The evaluation criteria used to determine the effectiveness of each floss type included assessment of: (a) dental plaque, (b) gingival crevicular fluid, (c) gingivitis and (d) gingival bleeding. Only the effects on dental plaque and gingivitis will be reported here.

Plaque Scores. At baseline, plaque was scored by modified index according to the criteria of Silness and Löe.[14] The modification was that the tooth was divided into sextants (mesiobuccal, distobuccal, midbuccal, mesiolingual, distolingual, midlingual) and scored separately for each. All plaque determinations were made by means of a front surface mirror and a Marquis Periodontal probe.§

Clinical Procedures. The study consisted of a 56 day experimental period, commencing 7 to 10 days after a thorough prophylaxis. Prior to the prophylaxis, determination of the oral hygiene status (S-OHI)[12] was made. Following prophylaxis, written consent was obtained from each subject, and an appointment was made for baseline examination.

At the baseline appointment, measurements of plaque, crevicular fluid, gingivitis, and gingival bleeding[16] were made. These measurements were done in this exact order so that the plaque and calculus determinations would not be affected by the other scoring methods. Standardized oral hygiene instructions were then given by means of a video tape, and individul questions were answered. Toothbrushes and dental floss were distributed.

The patients were recalled in 28 days, at the same time of day, for determination of plaque, crevicular fluid, gingivitis and gingival bleeding. The 28-day period was selected for ease of scheduling and to duplicate the same menstrual day for each female participant. Time of day was kept constant to avoid the influence of the circadian nature of crevicular fluid flow.[17] Supplemental supplies of dental floss were distributed and the patient dismissed.

The patients were again recalled 28 days later (56 days after baseline examination). Scores for plaque, crevicular fluid, gingivitis, and gingival bleeding were recorded. Time of day was the same as in each of the previous appointments. The patients were then informed of the end of the study, and appropriate arrangements were made to insure continued periodontal maintenance.

Statistical Analysis of Data. Three factor analysis of variance of the data was used to evaluate for differences between groups for plaque and gingivitis over the different sessions. The data were analyzed using The University of Michigan EB140 computer and the BMD08V program. The program performed was one of analyses of variance between type of floss, brand of floss, session

* John O. Butler Company, Chicago, IL 60611.

† Johnson and Johnson Company, New Brunswick, NJ 08903.

‡ Your Role in Oral Hygiene, Carole Souers, The University of Michigan.

§ Marquis Dental Manufacturing Company, Denver, CO.

(0, 28 and 56 days), and combinations thereof at the .05 level of significance.

RESULTS

Figures 1 through 4 show the results of analyses of variance on data from plaque and gingivitis for floss type and brand (combined waxed and unwaxed) over all three sessions. Mesiobuccal and mesiolingual scores were averaged into mean mesial scores while distobuccal and distolingual scores were averaged into mean distal scores. Each graph represents mean scores of all the teeth tested for that particular group at that particular session.

On the basis of analysis of variance:

Figure 1 shows that for plaque removal, on the mesial side of the test teeth, there was no significant difference between type or brand over all three sessions.

Figure 2 shows that for plaque removal, on the distal side of the test teeth, there was no significant difference between type or brand over all three sessions.

Figure 3 shows that for gingivitis, on the mesial side of the test teeth, there was no significant difference between type of brand over all three sessions.

Figure 4 shows that for gingivitis, on the distal side of the test teeth, there was no significant difference between type or brand over all three sessions.

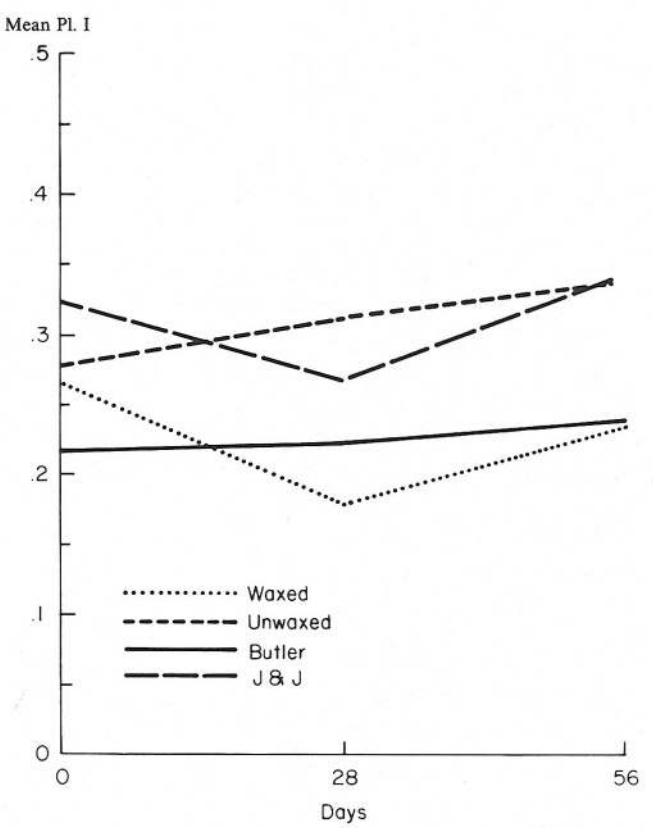

Figure 1. *Mean mesial plaque scores* (Pl.I.) *for both, types and brands, for each session. "Butler" includes both waxed and unwaxed. "Johnson and Johnson" includes both waxed and unwaxed.*

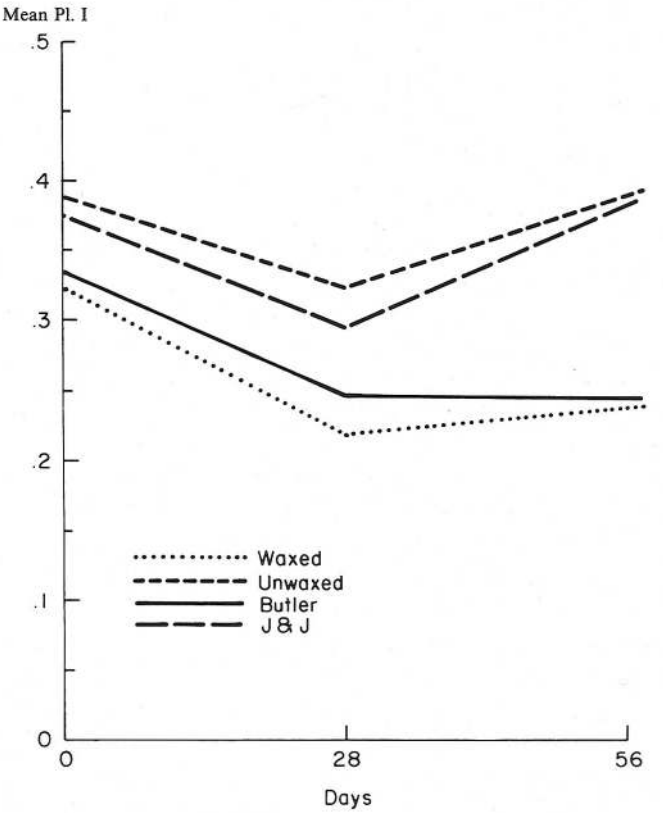

Figure 2. *Mean distal plaque scores* (Pl.I.) *for both, types and brands, for each session. "Butler" includes both waxed and unwaxed. "Johnson and Johnson" includes both waxed and unwaxed.*

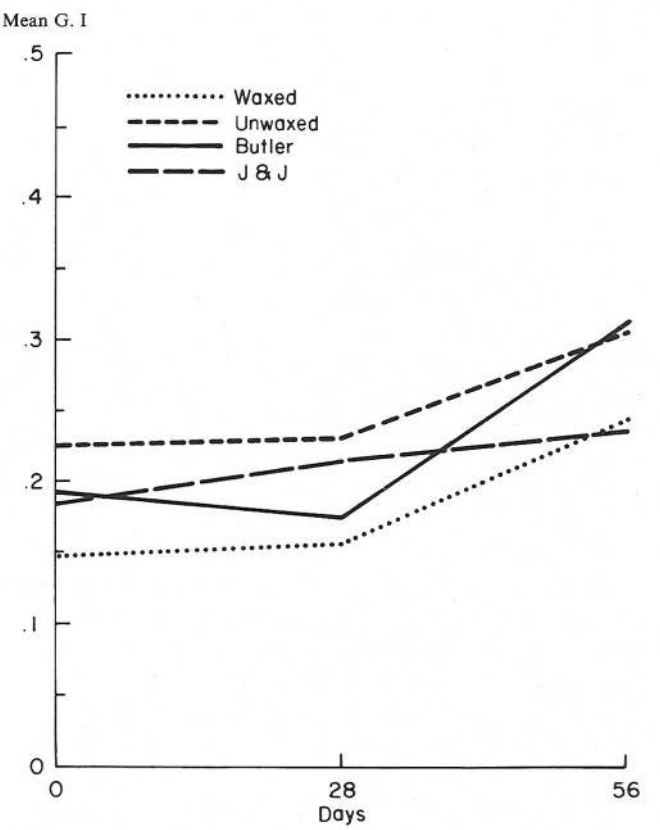

Figure 3. *Mean mesial gingivitis scores* (G.I.) *for both, types and brands, for each session. "Butler" includes both waxed and unwaxed. "Johnson and Johnson" includes both waxed and unwaxed.*

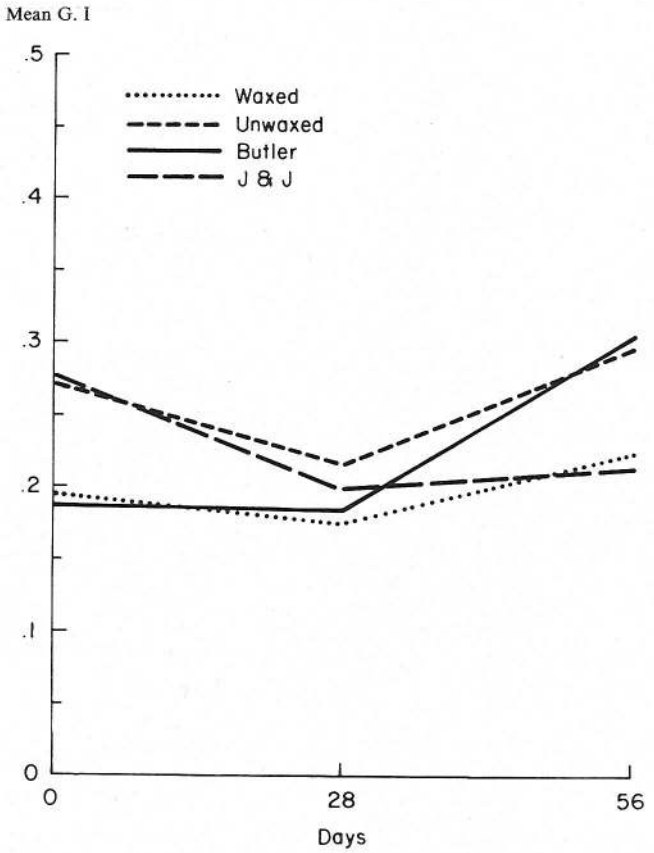

Figure 4. *Mean distal gingivitis scores* (G.I.) *for both, types and brands, for each session. "Butler" includes both waxed and unwaxed. "Johnson and Johnson" includes both waxed and unwaxed.*

DISCUSSION

The analysis of the data indicates that there is no advantage in using waxed or unwaxed floss, be it Johnson and Johnson or Butler. The data appear to be in agreement with previously cited studies[8–10] in which no differences were found between the cleaning efficiency of waxed and unwaxed floss. However, it is possible that in the present study no difference was found among the flosses due to the low initial level of plaque and gingivitis, the thoroughness of the oral hygiene procedures carried out by the patients each day, and the duration of the study.

In the study by Finkelstein and coworkers[8] using the Löe and Silness[15] gingival index, the baseline mean scores for their patients ranged from 0.69 to 1.00 as compared to 0.146 to 0.317 in this study. After 14 days, the scores in the above mentioned study ranged from 0.15 to 0.51.[8] In this study after 56 days, the scores ranged from 0.134 to 0.321. Although both studies showed no significance in type of floss used, the initial baseline scores for gingivitis were far from the maximum No. 3 score. This was also brought out in the study by Hill and coworkers.[9] Using the same gingival index, they had initial scores ranging from 0.1 to 0.5, with scores ranging from 0.2 to 0.7 at the end of the 7-day study. In their discussion, they mentioned that initial baseline scores were too low to conclude anything in reference to more severe disease situations.

As mentioned previously, there was no assurance that the patients were carrying out oral hygiene procedures as instructed. It must be emphasized, however, that there were patients in each of the four groups with no plaque or gingivitis throughout the study. This may indicate that plaque removal with a given floss depends on patient motivation.

Although the 56-day time period is the longest published follow-up in floss studies, perhaps it would be advantageous to extend such studies an additional 28 days. This would indicate better which floss is more effective over 3 months, the advocated recall interval for prophylaxis after periodontal surgery.[18]

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Send reprint requests to: Dr. David M. Lamberts, 2330 44th St, SE, Grand Rapids, MI 49508.