

The Effect of Waxed and Unwaxed Dental Floss on Gingival Health

Part II. Crevicular Fluid Flow and Gingival Bleeding

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EIGHTY PATIENTS, having received periodontal therapy previously, were divided into four groups, corresponding to one of four different types of dental floss being used. Seven to ten days after receiving a thorough prophylaxis, each patient had oral hygiene instruction by video tape, was given a toothbrush and a quantity of the test floss. At 0, 28 and 56 day intervals, the patients were scored for crevicular fluid flow and gingival bleeding. Data were analyzed statistically. Johnson and Johnson unwaxed dental floss was found to be slightly less effective in reducing gingival bleeding at the 56th day. It was also found that crevicular fluid flow was least with waxed floss use at the 56 day session. However, the range of variations was so minimal that no clinical significance could be ascribed to either finding. There were patients in each of the four floss groups with no fluid flow or bleeding during all three sessions.

In a co-publication¹ the gingival response to four different dental flosses on the bases of the Gingival Index² and the Plaque Index³ was reported. While the Gingival Index of Løe and Silness² is an often used index,⁴ the increasing popularity of indices that consider gingival fluid or bleeding suggests the need for studies that address that interest. The purpose of this communication is to report the effectiveness of two waxed and two unwaxed dental flosses in reducing crevicular fluid flow and gingival bleeding, when used in an oral hygiene program.

MATERIALS AND METHODS

Eighty periodontal maintenance patients were selected and divided into four groups. The study protocol, which was previously described,¹ consisted of a 56-day experimental period, during which the patients were scored for crevicular fluid flow and gingival bleeding at 0, 28 and 56 day intervals.

Gingival Crevicular Fluid. Crevicular fluid was determined by the Periotron§ gingival crevicular flow meter. Scores were obtained from the mesial and distal surfaces of the six teeth suggested by Ramfjord.⁵ A buccal ap-

proach to the interproximal area was used to avoid errors in positioning or contamination often encountered from lingual or palatal approaches. A dry, clean, filter paper strip was inserted into the machine to make a zero adjustment before each session. The area of the tooth to be examined was isolated with cotton rolls and gently dried with an air syringe. Using cotton forceps, a strip of filter paper was placed at the orifice of the crevice so that the bottom edge of the paper was no longer visible. This strip remained in place for 10 seconds as measured by a stopwatch; this allowed initial emptying of the sulcular pool. The strip was then removed and discarded, and the timer on the flow meter activated. The timer ran for 27 seconds, allowing the sulcus to fill. At the end of this time, a second strip was placed in the same manner as described above, and removed after 3 seconds (as measured by a stopwatch). This strip was then placed in the GCF flow meter, centered within the electrodes, up to the line marked on the strip, and the numerical readout obtained. The contacts of the meter were wiped with a clean cotton tip applicator after each reading was made.

Bleeding Tendency. Bleeding was assessed by a modified Gingival Bleeding Index using the technique of Carter and Barnes.⁶ The papillae on either side of the designated teeth⁵ were examined. To score bleeding at an experimental area, unwaxed floss|| was passed inter-

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|| Johnson and Johnson regular unwaxed.

proximally on both sides of the interdental papilla and carried into the sulcus. The floss was then moved in an inciso-gingival motion for one double stroke. Care was taken not to lacerate the papilla and a new length of clean floss was used for each interproximal unit. Thirty seconds were allowed before reinspection of each interproximal area. Evidence of bleeding was scored separately for each side of each papilla. Scores were recorded simply as bleeding presence or absence. The examiner made these determinations after all other experimental parameters were recorded.

Statistical Analysis. A series of three-factor analysis of variance was performed for crevicular fluid flow, one for each combination of variables (type, brand, session) and for each of the surfaces studied (mesial, distal), at the 0.05 level of significance. In addition, gingival bleeding was evaluated by Chi-square analysis, because of the dichotomous variable (absence or presence) generated by the Carter index. All floss combinations were considered for each site and for each session.

RESULTS

Mean mesial crevicular fluid flow scores are reported in Figure 1. Floss types and brands are reported. Analysis of variance indicated a significant type-session interaction ($P 0.05$). Similarly, mean distal crevicular fluid flow readings, shown in Figure 2, demonstrated a significant type-session interaction ($P 0.01$).

Mean crevicular fluid flow scores generally increased at 28 days (Session 2) and then decreased to levels below baseline at 56 days (Session 3). Users of waxed dental floss demonstrated the greatest improvement. Distal crevicular fluid flow scores in waxed floss users steadily decreased throughout the study. The mean range of scores was less than one Periotron unit. There were patients in all groups with no detectable crevicular fluid flow at any session.

Mean mesial bleeding presence is reported in Figure 3. Bleeding presence was seen to remain relatively stable between the baseline and 28 days. Between 28 and 56 days there were noticeable increases. The greatest occurrence was in the unwaxed floss users, where bleeding more than doubled between 28 and 56 days. No statistically significant variations were seen at Session 2 (28 days). At Session 3 (56 days) a statistically significant variation ($P 0.01$) was seen when Johnson and Johnson unwaxed floss was compared with either Johnson and Johnson waxed or Butler unwaxed. In each instance the Johnson and Johnson unwaxed performed poorer.

Mean distal bleeding presence is reported in Figure 4. Both brands showed patterns similar to the mesial results, with relative stability between baseline and 28 days and subsequent increases between 28 and 56 days. However, decrease in bleeding was seen in waxed floss users while increasing bleeding was seen for unwaxed floss users. No statistically significant variations were seen at Session 2 (28 days). At Session 3 (56 days) statistically significant

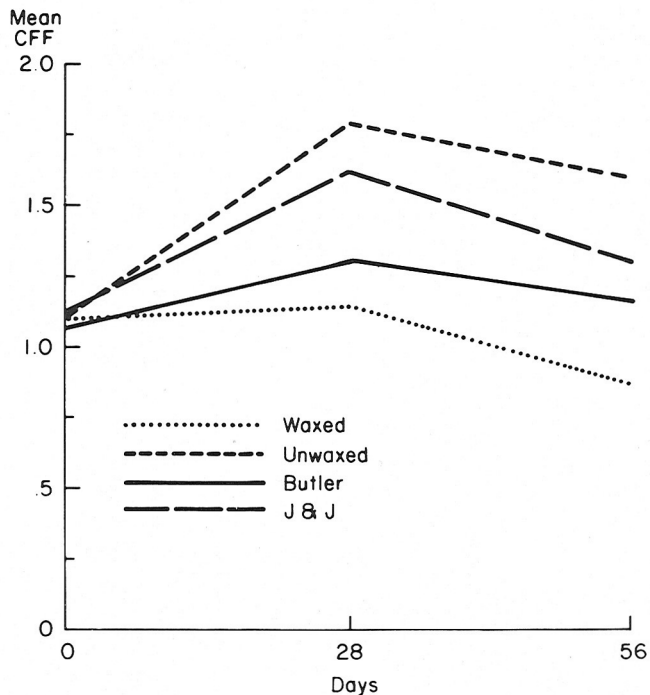


Figure 1. Mean mesial crevicular fluid flow scores (Periotron units) for both types and brands for each session. "Butler" includes both waxed and unwaxed floss. "Johnson and Johnson" includes both waxed and unwaxed floss.

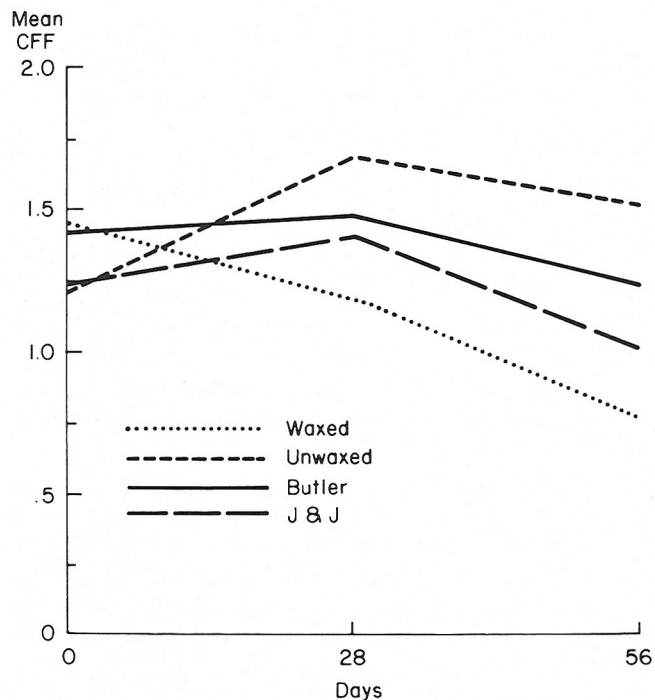


Figure 2. Mean distal crevicular fluid flow scores (Periotron units) for both types and brands for each session. "Butler" includes both waxed and unwaxed floss. "Johnson and Johnson" includes both waxed and unwaxed floss.

variations were seen when Johnson and Johnson waxed was compared with Butler waxed ($P 0.01$), or Johnson and Johnson unwaxed ($P 0.05$). In addition a statistically significant variation ($P 0.05$) was seen between Butler unwaxed and Johnson and Johnson unwaxed. There was

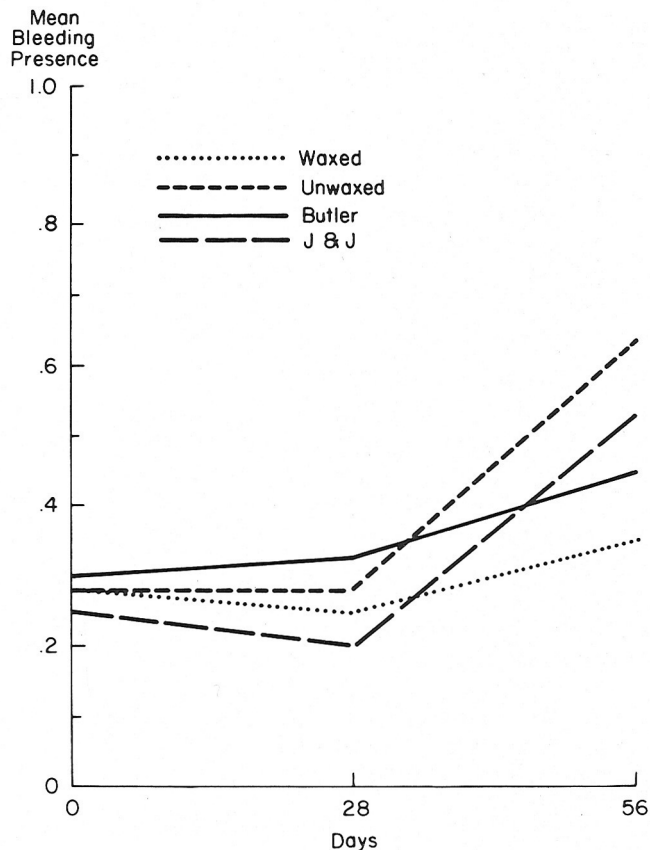


Figure 3. Mean mesial bleeding presence (modified Carter and Barnes) for both types and brands for each session. "Butler" includes both waxed and unwaxed floss. "Johnson and Johnson" includes both waxed and unwaxed floss.

increased bleeding in each instance with Johnson and Johnson unwaxed.

There were patients in all groups with no observed gingival bleeding at all sessions.

DISCUSSION

Although some investigators⁷⁻⁹ have reported no difference between the cleaning efficiency of waxed and unwaxed dental floss, Carter et al.¹⁰ found that the gingival bleeding was reduced more rapidly with unwaxed rather than waxed floss. The present findings are in conflict with that report.

Carter and Barnes' Bleeding Index⁶ considers only "presence" or "absence" of bleeding with no provision for quantity or speed of response. The index was intended for use as an oral hygiene goal (nonbleeding), not as a discriminating experimental index. No reports are available which evaluate the possible usefulness of such an index in "long" term trials. Therefore, attempting to draw clinical significance from such data may be unwarranted. In the present study, most patients demonstrated less than six total bleeding sites (possible 72) during the entire period, regardless of brand-type. There were individuals in all groups exhibiting no bleeding at any session. It can be concluded that good gingival health, as determined by the Gingival Bleeding Index, can be

maintained regardless of floss type or brand for a period of 56 days.

Baseline mean *distal* bleeding presence showed an increased range in all subjects when compared with mean *mesial* bleeding presence. Distal plaque and gingivitis scores were also higher initially than their mesial counterparts. However, this apparent positive correlation disappears in the later sessions. Distal bleeding presence was seen to rise at 28 days and generally continue rising through day 56, as distal plaque and gingivitis scores dropped noticeably at 28 days and only a portion returned to even baseline values at 56 days. While a possible correlation exists for the period 28 to 56 days, the overall inconsistent relationships would suggest that mean bleeding presence is not directly correlated with either mean plaque or gingivitis scores. This is puzzling in view of the presence of bleeding criteria in the Gingival Index.² It may simply be that the range of all scores here was so limited and low that no consistent pattern could develop.¹ An analysis of any possible correlations within all data collected is the subject of a future publication.

Higher baseline scores for distal surface bleeding, gingivitis, and plaque as compared to their mesial counterparts suggests increased difficulties in maintaining gingival health on distal surfaces.

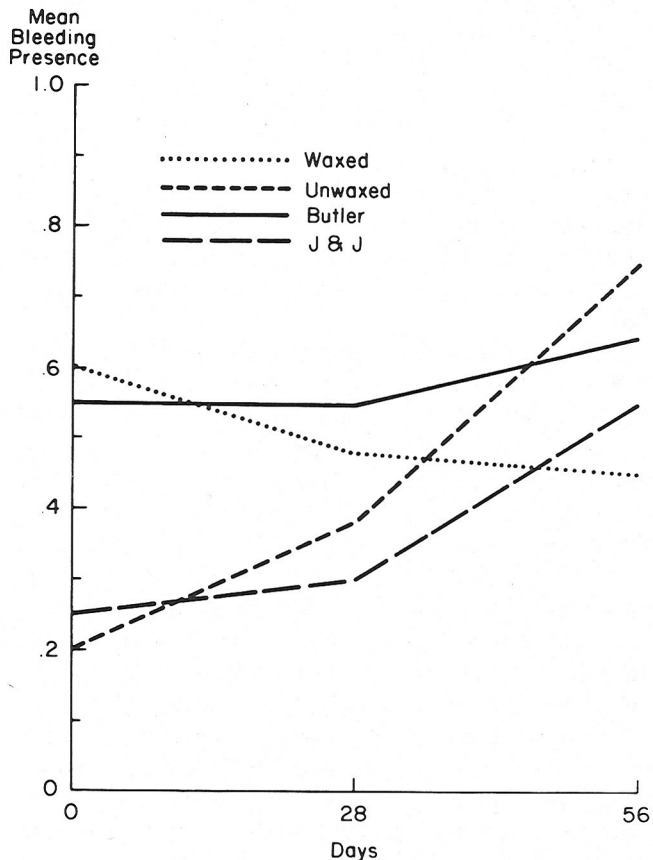


Figure 4. Mean distal bleeding presence (modified Carter and Barnes) for both types and brands for each session. "Butler" includes both waxed and unwaxed floss. "Johnson and Johnson" includes both waxed and unwaxed floss.

Previous studies have not evaluated gingival response to floss types on the basis of gingival crevicular fluid flow. Most patients in this study demonstrated little or no crevicular fluid. Good gingival health, as measured by the Periotron, was maintained at the end of 56 days by use of toothbrush and floss, regardless of type.

In the present investigation, waxed dental floss was more effective in reducing crevicular fluid flow (GCF) at 56 days than unwaxed dental floss. One could simply conclude that unwaxed floss is not as efficient in maintaining gingival health. However, the composition of the experimental groups may also have been a factor. A few patients demonstrated "higher" GCF scores (10-20) throughout the study. Such patients were found only in the groups using unwaxed dental floss. Nearly all patients demonstrating crevicular fluid readings above 10 were found to have oral hygiene scores higher than the remaining subjects prior to the study. This suggests possible inabilities and/or lack of motivation to adequately manipulate oral hygiene aids in certain test subjects. While all subjects reported using the brush and floss daily, the oral hygiene scores of these few would indicate that during previous 2 to 3 month periods in maintenance phase, daily use may not have been their habit. More carefully matched groups may have minimized this possible factor allowing more meaningful analysis of the statistical significance. The group composition consideration may well be a strong contributing factor to the apparent differences in bleeding tendencies between waxed and unwaxed users. Clinically, this statistical significance may not be important.

It is important to consider that the mean range of Periotron scores was close to one Periotron unit. Also, the overall range of scores for all patients at any individual site was 0 to 20. The range of individual scores was generally 0 to 10 or less. A variation of one unit in a scale which ranges from 0 to 200 could result from minor clinical or environmental variations in sampling from session to session. Therefore, any apparent statistical significance in such a range has questionable significance when recommending one floss type over another.

Mean fluid flow increased at 28 days, and its significant decrease at 56 days does not appear to be a matter of type or surface. This pattern is not unlike that reported in longitudinal studies of experimental periodontitis in beagle dogs.¹¹ Within 2 to 4 weeks after the beginning of plaque accumulation the established periodontal lesion may be observed.¹² It is during this period that "spiking" of fluid measurements is noted and establishment of a plateau has been reported.¹¹ The initial acute inflammatory lesion is replaced by a chronic lesion.¹² Since fluid production could be theorized as the expression of a dynamic process influenced both by production and uptake, changes in any one parameter could offset variations in another. For example, an increase in the rate of capillary transudate production (e.g. chronic lesion) need not necessarily result in an increased rate of fluid production if lymphatic capillaries can increase the uptake

of the transudate.¹³ Such a theory may explain the plateaus noted in longitudinal studies and suggested by the data in this study. While the experimental period here was not long enough for a more definite pattern to develop, what was seen may reflect an unsolicited "experimental gingivitis" in those areas not adequately cleaned by the patient.

As previously reported,¹ the same patients were scored for plaque³ and gingivitis.² There was no statistical evidence that any one floss was better in plaque removal or gingivitis prevention than any other tested. This is in agreement with most studies.⁷⁻⁹

The absence of any clearly definable pattern in the statistical analysis indicates that no apparent clinical differences exist between the efficiency of waxed and unwaxed dental floss. Any statistically significant differences appear to reflect minor imbalances within the experimental groups and not actual differences between floss types. The present findings would indicate that good gingival health, as measured by crevicular fluid or gingival bleeding, can be maintained for a period of 56 days by use of a toothbrush and dental floss, regardless of brand or type. When combining the data from both parts of this study, it would appear, from a clinical standpoint, that there is little difference between the cleaning ability of the different flosses tested.

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