

5-minute exposure, as compared to the control (Ref. 438).

Study 2, carried out by Drake et al. (Ref. 439), was designed to determine the antimicrobial activity of the combination formulation. A spectrum of oral microorganisms was exposed to various dilutions of the combination formulation (1:2 and 1:128) for times varying from 5 minutes to 2 hours. MIC's varied among the species tested. Periodontal pathogens, including *P. gingivalis*, *F. nucleatum*, *E. corrodens*, and *A. actinomycetemcomitans*, were among the more susceptible of the species tested, with MICs between dilutions of 1:64 and 1:28. Streptococci tended to be less susceptible. Under this protocol, *S. mutans* was inhibited by dilutions as low as 1:32, whereas in the previous study the combination

formulation appeared to be ineffective even at dilutions as low as 1:4 (Ref. 438). This apparent discrepancy with study 1 is likely due to the longer exposure time of the bacteria in study 2 (up to 2 hours). Exposures of 15 minutes at a dilution of 1:4, or 5-minutes at a dilution of 1:2, were needed to kill all *S. mutans* cells in this study. Because mouthrinses are seldom used clinically for more than 30 to 60 seconds, it is doubtful that these results reflect the antibacterial effect of the mouthrinse in actual use.

3. *Human clinical trials.* One 6-week, blinded, parallel clinical trial compared the relative efficacy of two of the three combination formulations on plaque and gingivitis in a human adult population (Ref. 438). Subjects were divided into three groups, using either

a commercial toothpaste and toothbrush (control), the "regular strength" (single-bottle) formulation and a commercial toothpaste and toothbrush, or the orthodontic strength" (twin-bottle formulation not containing five times the concentration of zinc chloride) and a commercial toothpaste and toothbrush. Following the baseline examination, each subject was instructed to brush twice a day and, if assigned to a mouthrinse, to use the rinse after brushing. Baseline and 6-week data included the Loe and Silness Gingival Index recorded on six surfaces per tooth, and Turesky's modification of the Quigley-Hein Plaque Index. A mean score per subject was calculated for each index. The results are in Table 16.

TABLE 16.—GINGIVAL INDEX AND PLAQUE INDEX SCORES FROM THE GROSSMAN STUDY (REF. 438)

| Experimental Groups | Baseline Gingival Index | 6-week Gingival Index | Baseline Plaque Index | 6-week Plaque Index |
|---------------------|-------------------------|-----------------------|-----------------------|---------------------|
| Group 1 (control) | 1.52 | 1.40 | 20.76 | 18.56 |
| Group 2 (1-bottle) | 1.48 | 1.32 | 19.91 | 11.73 |
| Group 3 (2-bottle) | 1.47 | 1.33 | 19.15 | 12.84 |

Although the reduction in gingival index score was statistically significant for all three groups, the clinical significance of this reduction was marginal at best. There were no statistically significant differences among the three groups. The plaque index reduction was statistically significantly better for the mouthrinse groups than for the control group. However, the control group lacked a placebo rinse to determine whether the difference in plaque reduction was due to the rinsing effect or to some of the active ingredients in the test rinses. The degree of plaque reduction for any of the groups is of questionable clinical significance, because it did not result in

any meaningful reduction of the gingivitis score.

In another double-blind clinical study (Ref. 440), 119 adults were fitted with a toothshield (for either the right or left mandibular quadrant) that was designed to prevent toothbrushing from disturbing plaque accumulation. All subjects received an initial prophylaxis and were assigned to one of three experimental groups, each of which brushed their teeth (except for the shielded quadrant) once a day and used a different mouthrinse formulation twice a day for 1 minute. The final examination took place after 3 weeks, and 102 subjects completed the trial. Two rinses were variations of the two-phase system formula used in the 1-

bottle and 2-bottle formulations. The third formulation was a control rinse dispensed as a two-phase system. The results show no statistically significant differences in gingival index scores or bleeding sites among the three experimental regimens, either on the shielded or nonshielded teeth.

Plaque scores (Modified Turesky Plaque Index) were higher on shielded versus nonshielded teeth. The plaque scores after 3 weeks were lower for the two test rinses compared to the control rinse for both shielded and nonshielded teeth. However, the differences in plaque scores, while statistically significant, were not clinically significant.

TABLE 17.—DATA FOR SHIELDED TEETH FROM THE BESSELAAR LABS STUDY (REF. 440)

| Experimental Groups | Modified Plaque Index Baseline | Mean \pm Std. Error 3-Week |
|----------------------------|--------------------------------|------------------------------|
| Data for Shielded Teeth | | |
| Group 1 (Test 1) | 2.21 \pm 0.08 | 2.73 \pm 0.08 |
| Group 2 (Test 2) | 2.14 \pm 0.09 | 2.61 \pm 0.09 |
| Group 3 (Control) | 2.15 \pm 0.09 | 3.03 \pm 0.09 |
| Data for Nonshielded Teeth | | |
| Group 1 (Test 1) | 1.95 \pm 0.07 | 1.76 \pm 0.07 |
| Group 2 (Test 2) | 1.88 \pm 0.08 | 1.63 \pm 0.09 |