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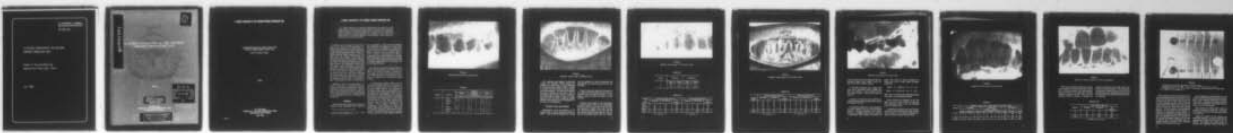
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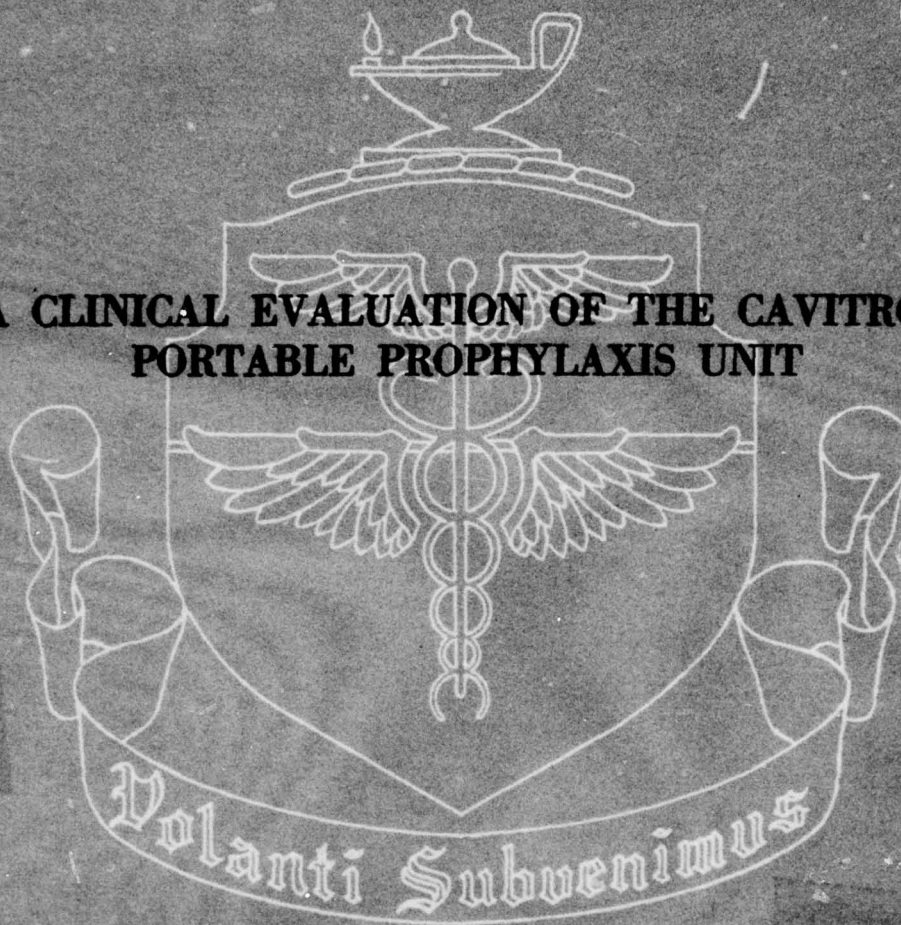
SCHOOL OF AVIATION MEDICINE  
RANDOLPH AIR FORCE BASE, TEXAS

JULY 1959

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**A CLINICAL EVALUATION OF THE CAVITRON PORTABLE PROPHYLAXIS UNIT**

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**59-86**

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SCHOOL OF AVIATION MEDICINE, USAF  
RANDOLPH AFB, TEXAS**

**July 1959**

## A CLINICAL EVALUATION OF THE CAVITRON PORTABLE PROPHYLAXIS UNIT

A clinical evaluation of the ultrasonic scaling technic was carried out on 240 military subjects. The ultrasonic technic was found to be as effective as the conventional scaling method in the removal of calculus while the conventional oral prophylaxis technic was superior to the ultrasonic method in the removal of stain. Most of the subjects preferred the ultrasonic method of oral prophylaxis over the conventional scaling technic. No statistical difference in tooth sensitivity or tissue trauma was noted between the two scaling technics.

Evaluation of the ultrasonic dental instrument<sup>1</sup> as an adjunct in oral prophylaxis is a problem now confronting the dental profession. Several investigators have reported satisfactory results with the ultrasonic method. Zinner (1) found no adverse clinical symptoms in patients scaled with the ultrasonic instrument. He also noted a lower degree of root sensitivity and very little gingival hemorrhage. Johnson and Wilson (2) scaled ten clinical patients with heavy calculus. They demonstrated that ultrasonic energy could successfully remove stain and calculus. Wilson (3) reported that patients expressed a preference for the ultrasonic method. He noted that the ultrasonic technic is not nearly so effective as the rubber polishing cup for removing stain. Mallernee (4) studied the effect of ultrasonic energy on the periodontal membrane, alveolar bone, and gingivae of dogs. He observed no injury to these tissues.

Additional clinical and experimental research is necessary to supplement these preliminary reports before accepting the ultrasonic method for routine oral prophylaxis. The purpose of this investigation was to compare the clinical effectiveness of the ultrasonic method of oral prophylaxis with the conventional scaling technic.

### METHOD

Two hundred forty male military personnel needing an oral prophylaxis were utilized in

this investigation. Large numbers of patients from Randolph and Lackland Air Force Base dental clinics were available for screening and selection of three groups of 80 patients having slight, moderate, or severe calculus (figs. 1 to 6). Subjects were examined by the investigators, who recorded the degree of gingivitis, periodontitis, and calculus. A minimum of 5 teeth in each quadrant was required. Ages of subjects ranged from 17 to 46 years, the mean being 23.5 years.

To avoid the preference that graduate hygienists might show for one technic over the other, two dental technicians, untrained in oral hygiene procedures, were selected as operators. They were given an intensive four-month course in ultrasonic and conventional scaling technics.

A predetermined scaling pattern was assigned to all subjects (fig. 7). One upper and one lower quadrant were always scaled by the ultrasonic method (fig. 8). The quadrants to be scaled by each method were randomly selected so that all of the four possible patterns were used before one was repeated. Each quadrant was scaled for *exactly* ten minutes. Comparable instruments were selected for the two scaling technics (fig. 9). The rubber polishing cup was used with only the conventional scaling method. Each operator performed 120 prophylaxes. This included 10 subjects per pattern within each calculus group. The operator noted the number of teeth scaled by each technic. He also noted the presence or absence of tooth sensitivity during scaling procedures.

Received for publication on 29 April 1959.

<sup>1</sup>Cavitron portable prophylaxis unit, model 30. Cavitron Equipment Corp., Long Island City 1, N.Y.



**FIGURE 1**

*Maxillary calculus typical of the slight group.*

**TABLE I**

Operator	Gingivitis	Calculus								
		Slight			Moderate			Severe		
		Periodontitis								
		Sl	Mod	Sev	Sl	Mod	Sev	Sl	Mod	Sev
B	Slight	31	1		17	1		1	2	
	Moderate	7	1		17	4	1	21	8	1
	Severe							2	4	1
P	Slight	35	1		14				2	
	Moderate	4			16	9	1	24	8	1
	Severe							3	2	



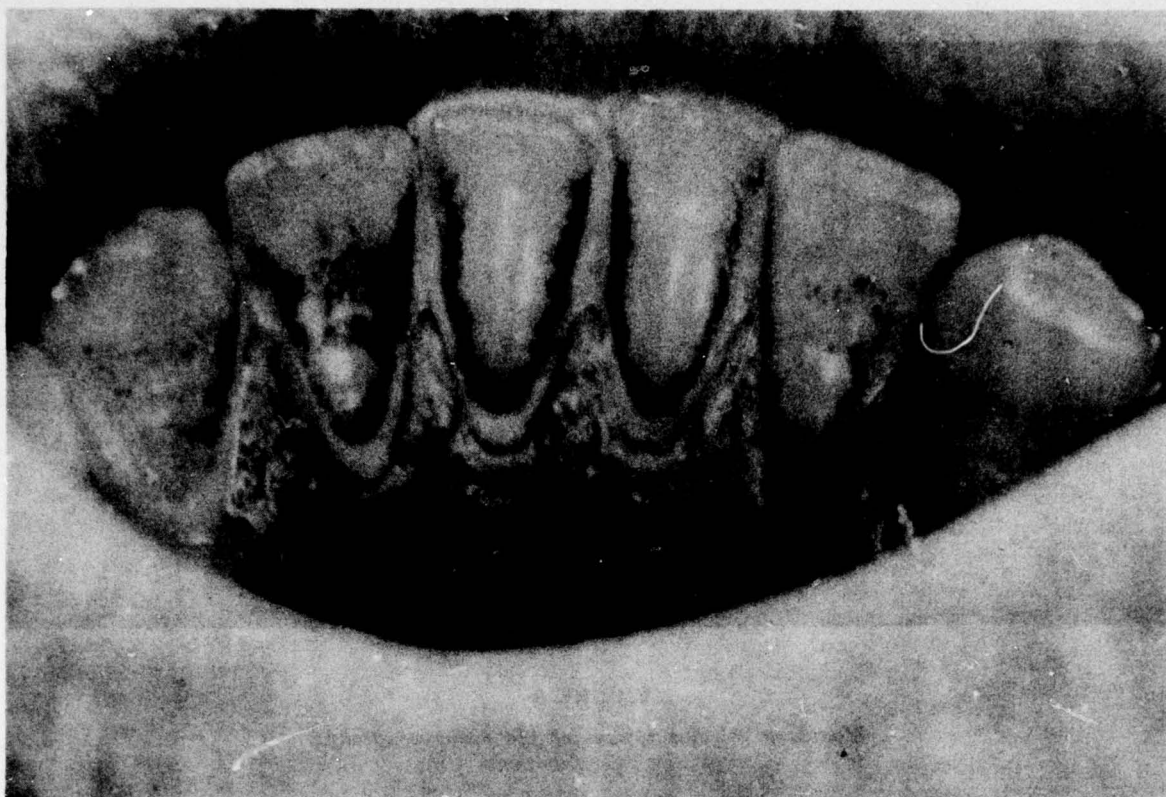


FIGURE 2

*Mandibular calculus typical of the slight group.*

The evaluation was designed to determine whether the ultrasonic scaling technic was equivalent to, better than, or not as effective as the conventional scaling method in regard to calculus and stain removal, tissue trauma, and tooth sensitivity. The patient's preference for scaling method was also noted. The investigators compared the results of ultrasonic and conventional scaling in both the upper quadrants and the lower quadrants. Scaling patterns were unknown to the investigators at the time of the evaluation.

#### FINDINGS AND DISCUSSION

Classification of the oral condition of the subjects prior to oral prophylaxis is shown in table I. This three-way classification reveals

that the incidence of calculus, gingivitis, and periodontitis was about the same for the two operators.

Table II shows the mean and the range in the number of teeth cleaned per mouth by the ultrasonic and conventional methods. A comparable number of teeth was scaled by both methods.

The data were examined to see if the degree of calculus present prior to the prophylaxis could be a factor in the result of the two scaling technics for calculus and stain removal. The chi-square analysis of the data for the two jaws is presented with table III. The degree of pre-existing calculus was not a factor



FIGURE 3

*Maxillary calculus typical of the moderate group.*

TABLE II

Operator	Ultrasonic		Conventional	
	Mean	Range	Mean	Range
B	13.9	11-16	13.9	11-16
P	14.3	11-16	14.3	11-16

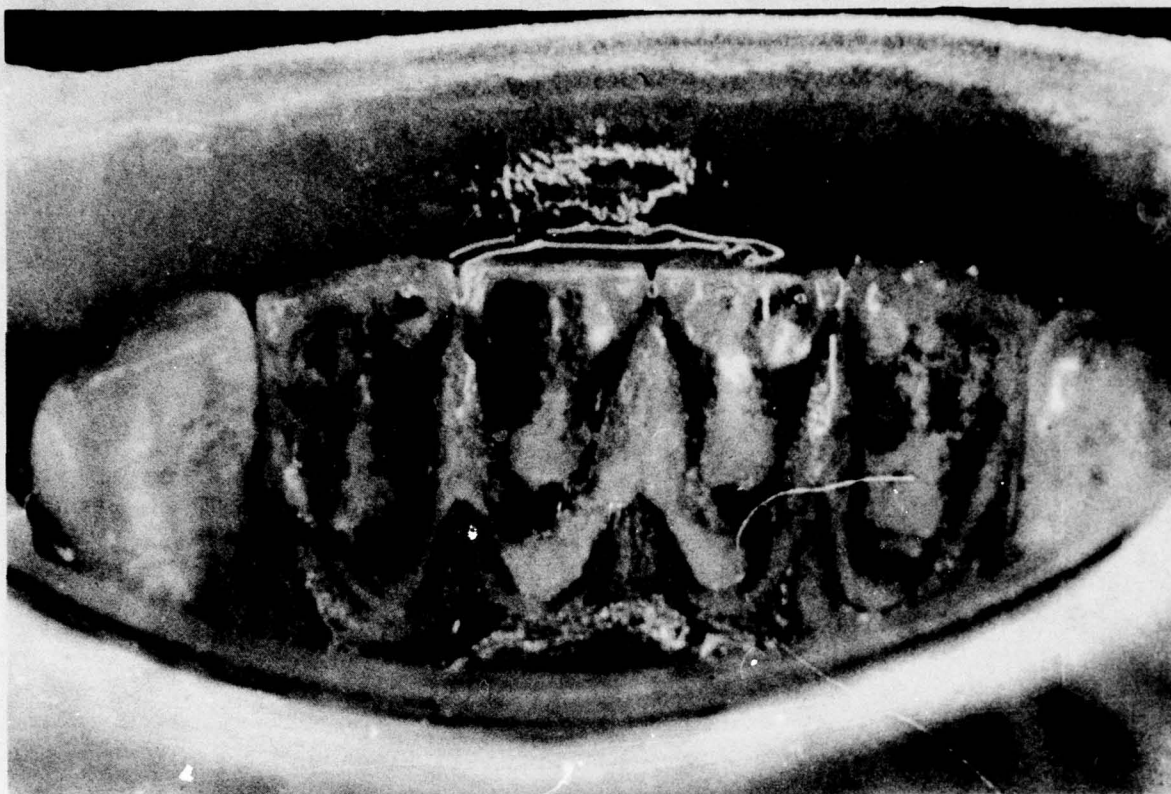
TABLE III

Degree of calculus	Calculus removed better by			Stain removed better by		
	Ultrasonic	Conventional	No difference	Ultrasonic	Conventional	No difference
Slight	21	16	123	10	69	81
Moderate	35	21	104	14	74	72
Severe	37	20	103	10	76	74
Total	93	57	330	34	219	227

$$\chi^2 = 7.95, \text{ d.f.} = 4.$$

$$\chi^2 = 1.89, \text{ d.f.} = 4.$$





**FIGURE 4**

*Mandibular calculus typical of the moderate group.*

**TABLE IV**

Cleaning pattern	Calculus removed better by			Stain removed better by		
	Ultrasonic	Conventional	No difference	Ultrasonic	Conventional	No difference
1	23	16	81	12	52	56
2	25	15	80	12	51	57
3	19	18	83	4	64	52
4	26	8	86	6	52	62
Total	93	57	330	34	219	227

$\chi^2 = 5.60, d.f. = 4.$

$\chi^2 = 8.99, d.f. = 4.$



FIGURE 5

*Maxillary calculus typical of the severe group.*

in this evaluation since the ultrasonic and conventional techniques gave similar results for each of the three calculus groups.

A chi-square analysis also showed that there was no association between scaling patterns and calculus or stain removal by the two scaling methods. The data are given in table IV.

Instances of crown and root sensitivity by quadrant during scaling procedures are reported in tables V and VI.

No statistical difference in tooth sensitivity was found between the two oral prophylaxis methods. Operator variability was a factor, however; in comparing the subjects' reactions, a statistically larger number of operator B's

group were found to report sensitivity in crowns and roots of teeth during ultrasonic procedures.

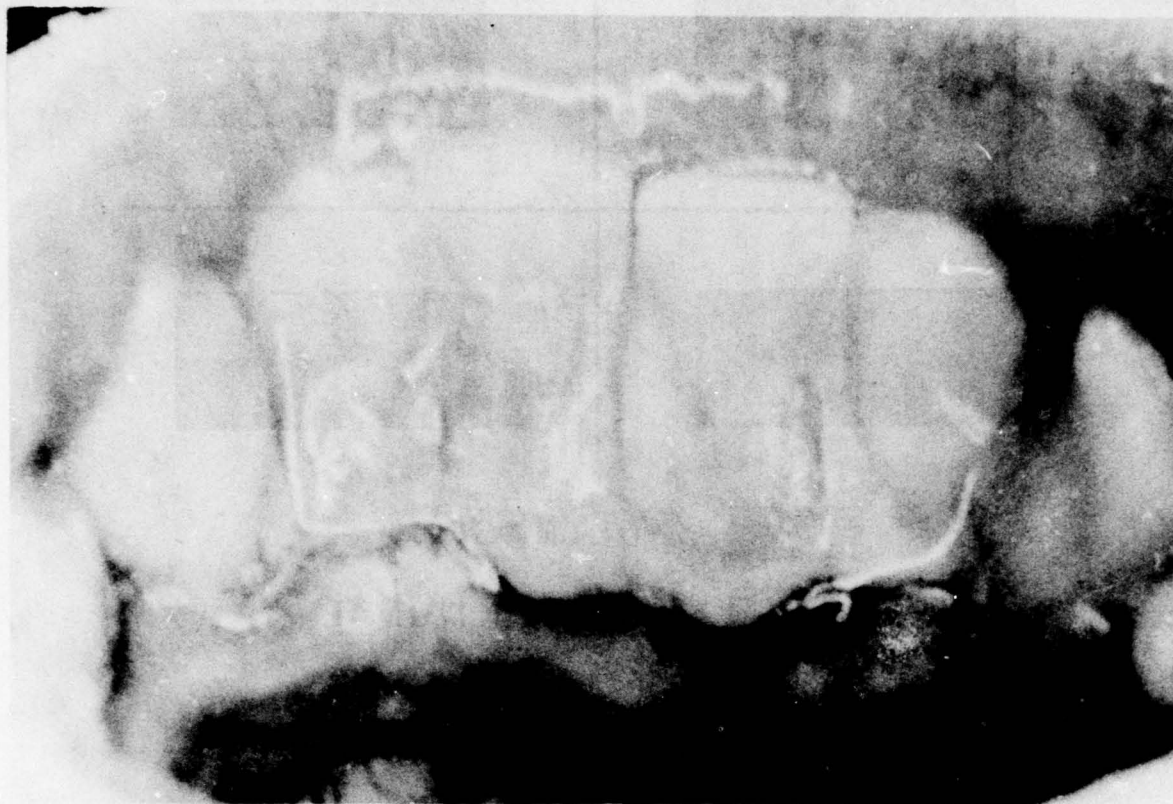
Crown:  $\chi^2 = 26.52$ , d.f. = 2,  $P < .01$ .

Root:  $\chi^2 = 23.14$ , d.f. = 2,  $P < .01$ .

There was no residual tooth sensitivity present with either oral prophylaxis technic.

Tissue trauma was different on the two sides of the jaw only 5 percent of the time. This difference, however, was not associated with the method used.

A significant association was found between the operator and the method he used in cleaning the teeth for both calculus and stain removal as shown in tables VII and VIII.



**FIGURE 6**

*Mandibular calculus typical of the severe group.*

**TABLE V**

Operator	Method to which crown of teeth sensitive while being cleaned								
	Ultrasonic			Conventional			Not sensitive		
	Degree of calculus								
	Slight	Moderate	Severe	Slight	Moderate	Severe	Slight	Moderate	Severe
B	9	14	14	5	7	8	146	139	138
P	1		6	1	2	6	158	158	148
Total	10	14	20	6	9	14	304	297	286



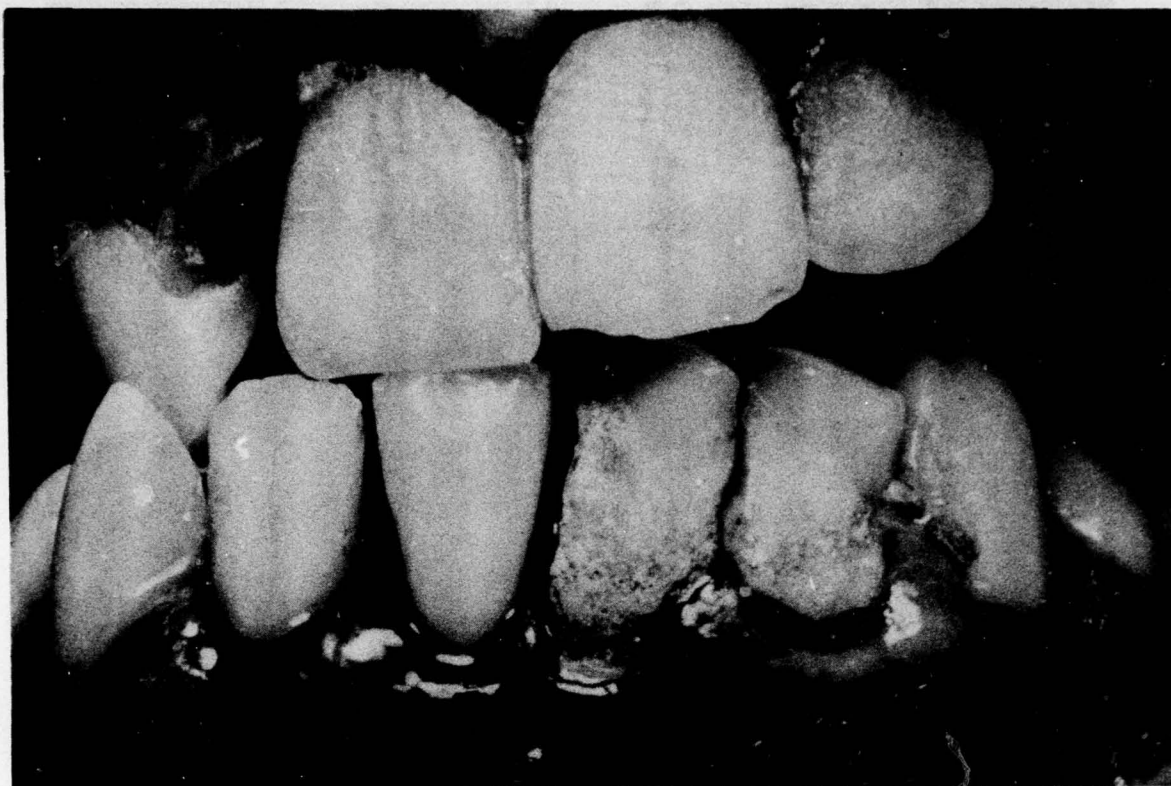


FIGURE 8

*Subject after ultrasonic scaling of the lower right quadrant.*

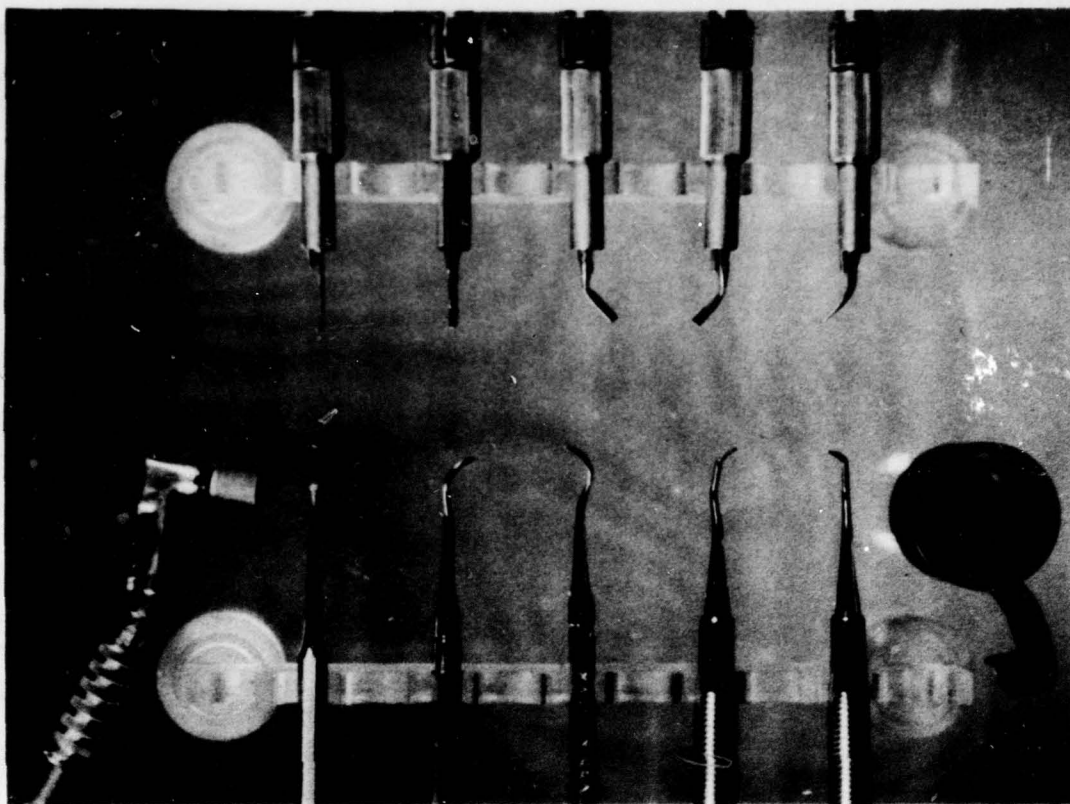
There was no statistical difference between the two methods of calculus removal for operator B. However, operator P was more successful than operator B in using the ultrasonic method to remove calculus. When the two methods differed in removal of calculus, the

ultrasonic method gave the better result in 62 percent of the 150 instances. This 62 percent is statistically different only at the .05 level from the 50 percent hypothesized if there were no difference in the removal of calculus by the two methods.

TABLE VIII

Operator	Stain removed better by		
	Ultrasonic	Conventional	No difference
B	12	76	152
P	22	143	75
Total	34	219	227

$$\chi^2 = 49.56, \text{ d.f.} = 2, P < .01.$$



**FIGURE 9**

*Conventional and ultrasonic instruments used in this study.*

*Ultrasonic (top row, left to right): No. P-7; No. P-1; No. P4-R; No. P4-L; No. P-3.*

*Conventional (bottom row, left to right): Zerfing scaler; Younger-Good No. 7; Younger-Good No. 8; Jaquette No. 2; Jaquette No. 3.*

Both operators removed stain better with the conventional method of cleaning teeth, although they differed statistically in the number of times each had a better result with one of the two methods (fig. 10). The conventional method removed the stain better in 87 percent of the 253 jaws in which the stain removal differed. This percentage was significantly different ( $P < .01$ ) from the 50 percent expected for no difference in stain removal. A conservative appraisal of the findings indicates that the ultrasonic technic is as effective as the conventional scaling method in the removal of calculus while the conventional oral prophylaxis technic is superior to the ultrasonic method in the removal of stain.

This investigation indicates that the conventional rubber polishing cup should be used in place of the ultrasonic scaling tips for polishing the teeth. Although it is possible to remove stain with the ultrasonic instrument, this procedure is too time-consuming.

Each subject was asked which of the two methods of cleaning he preferred. Preference was decidedly in favor of the ultrasonic method (see table IX).

Eighty-two percent of the subjects preferred the ultrasonic, 10 percent preferred the conventional method, and 8 percent were undecided. The reason most often given for choosing the ultrasonic method was that it

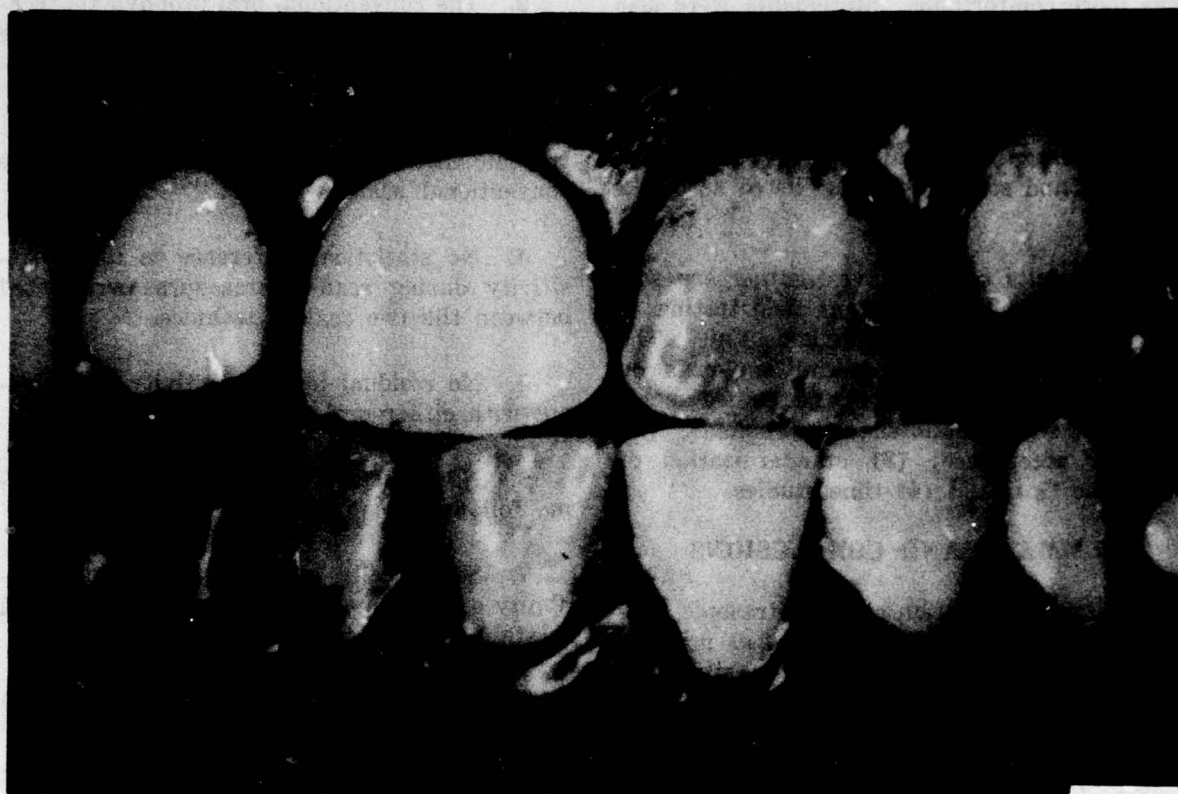


FIGURE 10

Comparison of stain removal using basic fuchsin indicator. The conventional technic with rubber polishing cup was used on the upper right and lower left quadrants; the ultrasonic technic was used on the upper left and lower right quadrants.

TABLE IX

Operator	Cleaning method preferred								
	Ultrasonic			Conventional			Neither		
	Degree of calculus								
	Slight	Moderate	Severe	Slight	Moderate	Severe	Slight	Moderate	Severe
B	32	31	36	8	6	3		3	1
P	30	34	34	3	1	2	7	5	4
Total	62	65	70	11	7	5	7	8	5



was more comfortable. Statements were also made to the effect that the ultrasonic method took less time, was easier, and made the teeth feel smoother. The objectionable feature most frequently mentioned by the subjects was the presence of an excess amount of water. The vibration and sound were also listed as objectionable.

The results of this investigation are sufficiently favorable to warrant field testing of the Cavitron portable prophylaxis unit. The field test should place special emphasis on problem areas which could not be studied in this laboratory: (1) maintenance problems; (2) operator acceptance; (3) standardization of ultrasonic tips; and (4) time studies.

### SUMMARY AND CONCLUSIONS

A clinical evaluation of the ultrasonic scaling technic was carried out on 240 military subjects. Equivalent experimental situations were formulated for the ultrasonic and conventional oral prophylaxis technics by incorporating the following features into the experimental design: (1) the use of operators having equal training in both scaling technics; (2) the selection of three equal groups of subjects having slight, moderate, or severe calculus; (3) the selection of subjects possessing a minimum of five teeth in each quadrant; (4) the use of predetermined scaling patterns for all subjects; and (5) the selection of conventional scaling instruments to match as closely as possible the ultrasonic scaling tips.

The following observations were made when the results obtained with the Cavitron portable prophylaxis unit were compared to those of the conventional oral prophylaxis technic:

1. The ultrasonic technic is as effective as the conventional scaling method in the removal of calculus.

2. The conventional oral prophylaxis technic is superior to the ultrasonic method in the removal of stain.

3. Most of the subjects preferred the ultrasonic method of oral prophylaxis over the conventional scaling technic.

4. No statistical difference in tooth sensitivity during scaling procedures was noted between the two scaling technics.

5. No residual tooth sensitivity was present with either oral prophylaxis technic.

6. No statistical difference in tissue trauma following scaling procedures was noted.

7. Statistically significant operator variability occurred in the findings of calculus and in stain removal and tooth sensitivity.

The authors are grateful for the technical assistance of S/Sgt. Emily Everett Taylor, S/Sgt. James E. Blaskovich, and A/2C George W. Pugsley, III.

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