



LEVEL

20

NDRI-PR 80-01
February 1980

ADA 086454

EVALUATION OF NAVY PLAQUE CONTROL PROGRAM, AT GREAT LAKES

BY

M. R. WIRTHLIN
E. B. HANCOCK
R. G. WALTER
J. C. CECIL

DTIC
ELECTE
JUL 7 1980
C

DISTRIBUTION STATEMENT A
Approved for public release
Distribution Unlimited

DDC FILE COPY

NAVAL
DENTAL RESEARCH
INSTITUTE

Naval Medical Research and Development Command
Bethesda, Maryland

80 7 2 029

NAVAL DENTAL RESEARCH INSTITUTE
NAVAL BASE, BLDG 1-H
GREAT LAKES, ILLINOIS 60088

20

EVALUATION OF THE NAVY PLAQUE CONTROL PROGRAM,
AT GREAT LAKES

BY

M. R. WIRTHLIN
E. B. HANCOCK
R. G. WALTER
J. C. CECIL

Research Program Report NDRI-PR 80-01
Work Unit M0095-PN003-3015
Naval Medical Research and Development Command
National Naval Medical Center
Bethesda, Maryland 20014

The opinions expressed herein are those of the authors and cannot be construed as reflecting the views of the Navy Department or the Naval Service at large. The use of commercially available products does not imply endorsement of these products or preference to other similar products on the market.

This document has been approved for public release; its distribution is unlimited.

Approved and released by:

M R Wirthlin Jr.
M. R. WIRTHLIN, JR.
Captain, DC, USN
Commanding Officer

Accession For
NTIS GRA&I
DDC TAB
US Navy and
JCS Publications
A

Individual clinicians who practice plaque control with their patients receive great reward and sense of accomplishment when dental caries is arrested and the gingivae return to a healthy state. After experiencing many such successes, clinicians have great faith in the efficacy of individual instructional measures and can testify strongly to the value of plaque control as hard-core therapy (1,2). Long term results in periodontal practices show that tooth mortality is lower than that of the general population. These results are not related to type of surgical therapy as much as to regular maintenance and patients' personal involvement in plaque control (3-6).

Plaque control has been shown in experimental work to be effective in returning the gingivae to health by physically rubbing the plaque from the teeth on a daily basis (7-10). Plaque, once removed, will reform quickly, hence sustained, daily hygiene performance is necessary. In the cited experimental studies, the subjects received continuous, intense supervision which is not possible in the community at large. There is no clear indication that any one device or technique is superior to another (11-22), but communication and motivation are probably prerequisites if sustained plaque removal effort is to be expected (23-30).

Most programs for plaque control in populations have taken individual instruction measures and merely expanded the program for use in group situations. These public health programs have not been evaluated, in most cases, but have been continued by the faith and zeal of those who started them. The evaluations of programs that have been done have not shown universal success on a long-term basis (31-41). Most evaluations have been performed with respect to school children. Those who manage the dental care of populations and are concerned for the health of their beneficiaries are justified in demanding an objective appraisal of the programs. It is important to know if the program is effective, if it can show a cost to benefit ratio which substantiates the expenditure of dental care resources, and to base such programs on previously demonstrated effectiveness. Research is needed to develop cost-effective public health programs which can be successfully demonstrated in the community before implementing in the population at large (42).

Oral hygiene techniques have been taught in the naval service since the turn of the century, and were organized in 1971 as a Plaque Control Program incorporated into the preventive dentistry effort of the Navy Dental Corps (43). The program requirements included plaque control instruction given through individual or small group sessions. The sessions were to include, as a minimum: education regarding the relationship between plaque, caries, and periodontal disease; demonstration of interproximal plaque removal techniques; demonstration of sulcular methods of tooth cleansing with the toothbrush; and instruction in the use of plaque disclosing media. The evaluation of the program in individual patients required that the clinicians' judgement determine minimal plaque formation, absence of bleeding on probing and the use of dental floss, and physiologic color and consistency (texture) of gingival tissue (44). Three prior evaluations on naval personnel have indicated only partial short-term effectiveness of teaching plaque control (45-47).

The purpose of this study was to survey the Navy Plaque Control Program and to obtain objective data with which to evaluate the effectiveness of the existing program.

Methods and Materials

This study was accomplished with serial examinations to assess the overall effect of the Plaque Control Program on caries activity and periodontal diseases. It was also designed as a field review and intra-group comparison of incidence. Because the subjects in the study would be handled in groups as ordinarily practiced at the clinics at the Naval Training Center, there was not a classical design of experimental and control groups, but rather a design which argued from logic that the greater the number of plaque control instruction sessions and treatments, the greater would be the response. It was acknowledged that for individuals, or in closely controlled scientific experiments, plaque control was worthwhile. The problem was to determine the effectiveness using group methods of plaque control instruction.

The sample. The subjects were young adult male recruits who volunteered for the naval service and began their basic training at Naval Training Center, Great Lakes, Illinois, between 15 September 1975 and 30 August 1978. The recruits were organized into company-sized clusters of up to 88 men each. In a two-phase sample, companies were selected from those being processed on Mondays, and a table of random numbers was used to select a representative sample of the recruit population. The subjects for long-term study were selected from the same clusters when they were potential candidates for specialty rating service schools at Great Lakes following basic training. There were 1186 subjects in all, 433 selected by random numbers and 753 selected for service school. Only 354 subjects selected for service school graduated and are reported upon in this study. The attrition of 53% was due to discharge from the Navy, or disenrollment from service school courses and transfer out of the area.

The examinations. The period of observation for subjects who completed the study was six months. The first dental examination was on the afternoon of the recruits' third day at basic training, before any dental treatment or preventive measures were performed. At that first visit for dental processing, recruits were examined for dental caries, missing teeth, restorations, plaque, calculus, and the periodontal diseases (Exam 1). Subjects received posterior bite-wing roentgenographs, supplemented by panoramic and periapical roentgenographs, when clinically indicated. After the examinations were completed, all subjects participated in the Navy's three-agent stannous fluoride self-preparation caries prevention treatment (48). The following morning, the subjects returned and with the aid of developed roentgenographs the dental caries charting was completed. They were again examined for plaque and periodontal diseases (Exam 2), and then received plaque control instruction in a large group. Eight weeks later, just before graduation from recruit training, subjects were again examined for plaque and periodontal diseases (Exam 3). Those who went on to a service school were given a fourth examination for plaque and periodontal diseases at the beginning of classes. The fifth and final examination was done 10 weeks later just prior to graduation from service school. The fifth examination was done in the same manner as the first examination.

The examinations were conducted in the dental clinics at Great Lakes with use of dental operating chairs and lights, mirrors, new No. 23 dental explorers and periodontal probes with Williams markings.* Compressed air and gauze sponges were available for drying the teeth. Roentgenographs were available as required.

At the first examination the subjects' random or service school selection was blind to the examiners. At subsequent examinations the number of preventive treatments or plaque control instructions was not revealed to the examiner. Since the examinations were performed at various clinics, it was not possible to make the examination number blind to the examiners. Whenever four or more subjects were present for examinations, one was returned to the examiner in non-specific order for a repetitive examination to determine intra-examiner reliability.

Charting of dental caries, missing teeth and restorations was a total recording by a dental assistant from limited examination** calls made by one examiner (RGW). Clinical caries was considered to be present in a tooth when any lesion had a detectably softened floor, undermined enamel, or softened wall (49). On an interproximal surface, the explorer point had to enter a lesion with certainty or the roentgenograph had to show penetration by caries. White, chalky, discolored, stained, rough areas, pits or fissures that merely caught the explorer, were not counted as caries unless accompanied by softening. When a tooth had a filling on a surface, and that surface also had caries, recurrent caries, or the filling was a temporary which required further treatment it was counted as carious. Stainless steel crowns were considered as permanent restorations. A deciduous tooth was classified, unless the permanent successor was also present. Third molars were excluded from the caries index, as were teeth lost or crowned due to trauma, congenitally absent, or removed for orthodontic reasons. Careful attention was paid to accurately depict the extent of restorations or caries on a special form (Figure 1) that separated anatomical sites geographically. From the data, the caries experience of each subject was determined as decayed, missing, and filled teeth (DMFT) and surfaces (DMFS) indices. At the first examination, missing teeth were counted as five surfaces. The same number of DMF surfaces as was recorded at the first examination was used for DMFS counts for teeth found to be missing at the final examination. The surfaces-at-risk (SAR) were computed as the sum of the unattacked tooth surfaces available for subsequent caries. The posterior proximal surfaces-at-risk (PPSAR) count excluded mesial surfaces of the first premolars.

The examinations for deposits on the teeth and periodontal diseases were done by two examiners (MRW and EBH). The first portion of the examination was a diagnostic opinion of gingival conditions, ordered into a hierarchy from healthy gingivae to chronic periodontitis. Steps in this ordinal ranking were based on inflammatory changes limited to interdental gingival papillae, to involvement of marginal tissues, and finally into attached gingivae with periodontal pockets formed. Also, a determination was made as to localized or generalized involvement. All six segments had to be involved, both on facial and lingual aspects,

*PW, Hu-Friedy, Chicago, IL.

**A full-mouth roentgenograph series was not available, but all visible lesions were noted on charts.

for the determination of generalized involvement. Roentgenographs were used in assessing conditions. At all five serial examinations, limited examination and partial recording* were done according to criteria of the Navy Periodontal Screening Examination (NPSE) (50), which is comprised of the Navy Periodontal Disease Index (NPDI) and the Navy Plaque Index (NPI). The NPDI was done as the second portion of the examination and was followed by an assessment of calculus. The periodontal probe was used while examining for calculus. The presence or absence of calculus (supra and subgingival) was determined on the four axial surfaces of the same six teeth examined for the NPDI; this was a modification of the Calculus Surface Index (CSI) (51). The subjects then rinsed for five seconds with one mouthful of water, followed by a 10 second rinse with a solution of two tablespoons of water and 0.5 ml erythrosine concentration.** The criteria of the NPI were not modified, except that an occlusal area evaluation was added. Criteria for the NPSE and recording forms are presented as Figures 2 and 3.

Treatment needs. After consultation with clinicians at the facilities treating recruits, periodontal treatment need case types were contrived as follows: Case Type I when the NPDI score for the worst tooth = 0 to 2, CSI = 0, and plaque control instruction (PCI) was required; Case Type II when NPDI Score = 0 to 2, CSI \geq 1, and PCI and oral prophylaxis (PRO) were required; Case Type III when NPDI Score = 5 to 7, CSI \geq 1, and PCI, PRO, and periodontal scaling (Pdt Scl) were required; Case Type IV when NPDI Score = 8 to 10, CSI \geq 1, and PCI, PRO, Pdt Scl, surgical (GVCTY) and post-operative (POT) care were required.

A comprehensive treatment plan was made for each subject. The rules for the formulation of the treatment plans were verified with senior clinicians at the recruit treatment clinic, and each subject's treatment plan was confirmed by two examiners. The first exam was the basis for an "initial projected treatment" plan. After the fifth examination was finished for each subject, his dental health record was abstracted to determine "dental procedures and services accomplished," and on the basis of data from the fifth examination a "projected treatment yet to be done" plan was made. These figures were used to determine any savings of treatment as a result of the Navy's Preventive Program.

This project was reviewed and approved by the Naval Dental Research Institute committee for the protection of human subjects. The data was recorded on the forms and punched onto Hollerith cards using unique serial identification codes for each subject to protect his identity. The data was analyzed on computers with the use of The Statistical Package for Social Sciences.*** Statistical significance was assumed when probability was 5% or less.

*Only six teeth are assessed in the NPSE.

**Trace Dental Disclosing Solution, The Lorvic Corp., St. Louis, MO.

***McGraw-Hill, Inc., New York, N. Y.

Results

The recruits selected for service school and long-term study were nearly identical to the random-selected recruits with regard to their initial dental caries experience (Exam 1 in Table 1). There were 1.9% of the service-school-selected recruits who were caries-free (DMFS=0), and 9.9% had no active carious lesions detected at the first exam. Their periodontal diseases status has been reported (52), and is summarized in Table 2 and Table 3. Calculus was found in over 97% of the service-school-selected recruits at first examination. Over three out of four (78%) had a pocket score of 5 or greater on one of the six teeth examined, and 3% had pockets on all six teeth. In general, they were a homogenous population in regard to periodontal disease because most were classified into the chronic marginal gingivitis categories.

The Plaque Control Program

After the first examination, all the subjects participated as a group in a stannous fluoride self-preparation. Under the supervision of a Navy Dental Technician, they polished their own teeth with a special pumice and stannous fluoride solution mixture which was applied with a brush for five to ten minutes. The subjects then rinsed, and shortly thereafter a 10% stannous fluoride solution was applied to their teeth for about 30 seconds.

After the second examination, all the subjects viewed a Navy film, "Your Teeth Are in Your Hands," (MN-11214-A). Subsequent to the 15 minute film, subjects participated as a group in a brushing and flossing exercise under the direction of a Navy Dental Technician.

In their third week of recruit training, the subjects' company had a day reserved for dental treatment. Some subjects participated as a group in brushing and flossing under supervision of Navy Dental Technicians, and saw short films which were part of a series. All in the group saw, "Dental Health Quiz" (MN-11214-E). If time permitted, they saw "Dental Health - Brushing" (MN-11214-C), and "Dental Health - Flossing" (MN-11214-B).

After their fourth examination, some service school subjects had a repetition of aforementioned preventive dentistry measures. They again saw "Your Teeth Are in Your Hands," flossed, and brushed with the pumice-fluoride mixture, followed by a topical application of stannous fluoride solution.

In the organized preventive dentistry operation at Great Lakes, the normal routine for recruits and service school students would be to receive two stannous fluoride self-preparation treatments and three group oral hygiene sessions. In fact, there was a wide range in the number and combinations of these treatments. The customary mode of instruction was in groups of 20 to 88. Individual plaque control instruction was received by 35% of subjects. This mode was usually an exhortation by the clinician while providing removal of calculus or restorative services. The curriculum of naval training during the first six months of naval

service left limited availability for routine dental care. The result was that only the most urgent caries problems received attention. Much less emphasis was placed on periodontal treatments for this group of young adults.

Only 16% of subjects received any periodontal treatments, which most often solely consisted of the use of ultrasonic devices. Only 7% of the subjects received definitive periodontal scaling.

Overall effect

The long-term result at six months in the cohort of service school graduates was a statistically significant 4% reduction in the total plaque score (see Exam 5 in Table 2). There was also a statistically significant, 10% reduction in calculus, and a parallel 8% reduction in the Navy Periodontal Disease Index. Both the gingival inflammation and pocket scores of the NPDI were reduced, but only the reduction in pocket score was significant. A comparison of the initial and final distribution of clinical diagnoses and treatment needs Case Types (Table 3), showed statistically significant shifts toward improvement in periodontal diseases status. The validity and reliability of the indices has been previously reported (52).

From the decrement of sound surfaces at risk recorded at the first and fifth examinations, the overall caries attack rate (CAR) was calculated as 2.5%. That is, for every 100 surfaces at risk, there were 2.5 new carious surfaces at six months. The posterior proximal CAR was 4.0%.

Dose-related effect

A summary of the changes in periodontal indices with increasing exposure to the Program is presented in Table 4. In most cases there was improvement, compared to baseline scores. The greatest amount of improvement in total plaque score was in the group who received the greatest number of doses of the Program. However, an analysis of variance showed that only for the calculus index was there a dose-related difference in improvement. There was no significant dose-related effect for caries attack rates, Table 5. In Table 6, a comparison of the added effect of individual hygiene instruction to group instruction, there were some instances of a significant added effect of individual instruction but no overall trend.

The results indicated that those who received the most exposure to the Program were those who had the highest plaque and calculus scores. They were also projected to need the greatest number of treatment procedures. The dental procedures and services accomplished in the clinics at Great Lakes, which were independent of the research examiners, were significantly higher for these groups (Table 7). Because those with the poorest oral health received priority in care, the groups of subjects at the fifth examination were not significantly different in treatment needs. It was not possible to determine any dose-related savings of treatment as a result of the Program. There were increases in dental caries in all groups, and approximately equal decreases in periodontal disease status in all groups except that those who were initially the worst improved the greatest amount.

The stannous fluoride self-preparation treatment between the first and second exams caused a slight, significant increase in gingival inflammation, attributed to abrasion in use of the pumice mixture. There was a significant reduction of the NPI, with most of the improvement occurring on the facial in the G (gingival) and R (remainder) areas. By the end of recruit training, there had been significant, slight decreases in gingival and pocket scores, however the plaque score had increased to near baseline level. In the period between the completion of recruit training and the start of service school there were no significant changes in the indices. In service school there was a significant decrease in plaque, and a decrease in the NPDI. Graphic representation of these changes is seen in Figure 4.

The distribution of the locations of plaques on the teeth (Table 8) showed that the locations least affected by the Program were the M (mesial) and D (distal) surfaces.

Costs

The costs of the treatments were determined during observation of instructional sessions at the clinics. The number and pay grade of the staff, the time of treatment, and the number of subjects in the group being instructed were the factors used to calculate costs. The subjects provided their own toothbrushes and dentifrice. The clinics provided an 18 inch length of dental floss or topical fluoride materials when required. The result was an estimated average cost of 30 cents per subject, for those who received all three scheduled Program sessions.

Discussion

A plaque control program is the sum of all measures performed by patients and dental professionals for the improvement and maintenance of dental and oral health. The Navy Plaque Control Program emphasizes cleanliness through personal oral hygiene practices performed by patients, and chemical control measures with fluoride compounds performed by professionals.

It is not enough to rest a program on the fact that Danish dental students acquired improved gingival health through disciplined oral hygiene measures (9). To be a true program in a public health sense, there must be demonstrated effectiveness through evaluation of the outcome on the actual recipients, followed by adjustments to keep the process refined and on target toward quantitative objectives. In this evaluation of the Navy Plaque Control Program it has been difficult to clarify the goals. The only written objective found was that healthy gingivae were the criteria for success for an individual patient, as determined by an individual clinician (44). There were no subjects with healthy gingivae seen in this study. The best estimate, from the data of this investigation, of an NPI score consistent with clinically acceptable gingival health would be a 35. That would require the average recruit subject to achieve and sustain a 50 point decrease in his NPI, from the time of his entry into the Navy. A program which achieved a portion of that, and then was

refined to achieve another increment, would suit a public health program approach of planning-implementation-evaluation. Without continuing evaluation there is no program, only directed activities.

Comparison is the essence of clinical trial, either with past events or with concurrent controls. In this investigation there were slight but significant improvements in before/after scores of the group for plaque, calculus, and periodontal disease indices after six months. There was no demonstrated effect on dental caries, but an interval of only six months may be inadequate to provide a reliable estimate of dental caries increment. It was not possible to arrange a control group who received no preventive dentistry in this field observation study. The within-group, dose-response comparison was theoretically valid. This evaluation used objective measurements and absence of bias by the examiners. However, subjects were not allocated equally nor randomly to dose groups. The clinic staff determined some allocation on the basis of amount or severity of treatment needs, and the subjects probably influenced some allocation by appearing or not appearing for scheduled preventive dentistry sessions.

There has been criticism of attempting plaque control instruction at a time when recruits are extremely busy learning to become sailors. The recruits may have been under pressures and dealing with anxieties that they did not have to face in civilian life and would not face in the fleet. However, once in the fleet dental care is not readily available; only about 70 of 400 ships have dental officers aboard. There is no alternative then, but to prepare naval personnel during training periods for extended deployments at sea. The Program is well-founded on the premise that problems of plaque-related diseases would continue to affect health if nothing were done.

A Plaque Control Program directed at physical removal of plaques by patients would be more effective if the patients were to change their behavioral pattern and clean their teeth thoroughly on a daily basis. Principles of patient education are known and recommended (53,54) but are not being implemented. The staff which presented the Program had little or no training in the effective use of techniques of educational psychology, and their training and motivation were not continued or reinforced. Instructional methodology is a skill which needs development. Few others of the professional staff were involved in supporting plaque control efforts in their daily treatment of patients. The sessions of hygiene instruction were usually presented in an authoritarian manner which might be received favorably by those of like persuasion, but rejected by anti-authoritarian persons. A sociological approach may be more likely to improve dental health (55,56). The mere repetition of instruction without reinforcing the personal benefit that accrues to the participant is not likely to change behavior.

The observed sessions of preventive dentistry tended to take responsibility for dental health out of the subjects' hands. After a "by-the-numbers" brushing drill, the subjects received fluorides, restorations, or gross calculus removal. There was no structured

occasion for a subject to realize significant success in his personal daily plaque control by observing the associated reduction in his gingival inflammation, swelling, and bleeding.

The greatest area of malhygiene in the naval recruits was between the teeth. The proximal surfaces of posterior teeth are known to be prime sites for harboring the cariogenic Streptococcus mutans infections in dental plaques (57). These areas had a high caries attack rate in this study. The proximal surfaces are considered the initial sites of incipient gingivitis (58). In considering the trade-offs needed for cost-effectiveness, it might be concluded that a strategy for plaque control in naval recruits would be to spend the limited time that they are available for dental care by concentrating hygiene instruction and fluoride treatments at the area of greatest risk (i.e., posterior proximal areas). Toothbrushing alone is not apt to remove destructive agents from caries-susceptible areas on the teeth (59).

The costs of the present program are very low compared to the costs necessary for the treatment of disease. The effectiveness could be improved by a complete educational, social and dental diagnosis of the problem and by continuing evaluation.

Summary and Conclusions

A field review of the Navy Plaque Control Program, as carried out at the Naval Training Center, Great Lakes, was conducted. Serial examinations were made of recruits from the beginning of the basic training until the completion of specialty training, a period of six months. Following the final dental examination, the number of preventive dentistry dose exposures were related to before/after changes in plaque and disease indices.

There were statistically significant short-term reductions of plaque, and, although subjects returned to near the initial base-line levels of plaque and gingivitis, there was a slight improvement in overall periodontal status. Since only the most urgent periodontal problems were treated, it appeared that the Plaque Control Program served to maintain the health of the population.

It is suggested that quantitative goals be set and continually evaluated. Training material should be available so that all clinical personnel can develop skills in communication and motivation. The Plaque Control Program for recruits should be directed at their educational level and be relevant to their social felt needs. The Program should concentrate on the interdental areas where the greatest payoff could be obtained in reduced dental and oral disease.

Acknowledgements

The authors are indebted to the assistance of Navy Dental Technicians DT1 J. McCormick, DT2 G. Bailey, DT2 S. Hoefs, DT3 J. Ellingson, and DT3 E. Pepper; Navy Dental Officers C. Emery, J. R. Lohr, and E. McLaughlin; and Department of the Navy civilians D. Pinneo, E. Mandel and M. Rouse.

Bibliography

1. Ariaudo, A., Arnim, S., Greene, J. E., and Loe, H. How frequently must patients carry out effective oral hygiene procedures in order to maintain gingival health? *J. Periodontol.* 42:309, 1971.
2. Arnim, S. The effect of thorough mouth cleansing on oral health - a case report. *Periodontics* 6:41, 1968.
3. Oliver, R. C. Tooth mortality following periodontal therapy. *J. Dent. Res.* 47:129 (abstract No. 353), 1969.
4. Lovdal, A., Arno, A., Schei, O., and Waerhaug, J. Combined effect of subgingival scaling and controlled oral hygiene on the incidence of gingivitis. *Acta Odont. Scand.* 19:537, 1961.
5. Knowles, J. W. Oral hygiene related to long-term effects of periodontal therapy. *J. Michigan Dent. Assoc.* 55:147, 1973.
6. Rosling, B., Nyman, S., and Lindhe, J. The effect of systematic plaque control on bone regeneration in infrabony pockets. *J. Clin. Periodontol.* 3:38, 1976.
7. Koch, G. and Lindhe, J. The effect of supervised oral hygiene on the gingiva of children. *J. Periodont. Res.* 2:64, 1967.
8. Lindhe, J., Koch, G., and Mansson, U. The effect of supervised oral hygiene on the gingiva of children. *J. Periodont. Res.* 1:268, 1966.
9. Loe, H., Theilade, E., and Borglum-Jensen, S. Experimental gingivitis in man. *J. Periodontol.* 36:177, 1965.
10. Lang, N. P., Cumming, B. R. and Loe, H. Toothbrushing frequency as it relates to plaque development and gingival health. *J. Periodontol.* 44:396, 1973.
11. Bernier, J. L., Sumnicht, R. W., Lancaster, J. E., and Monahan, J. L. A comparison of three oral hygiene measures. *J. Periodontol.* 37:267, 1966.
12. Ash, M. M. A review of the problems and results of studies on manual and power toothbrushes. *J. Periodontol.* 35:202, 1964.
13. Horowitz, A. M. and Suomi, J. D. A comparison of plaque-removal with a standard or an unconventional toothbrush used by youngsters. *J. Periodontol.* 45:760, 1974.
14. Robertson, N. A. E. and Wade, A. B. Effect of filament diameter and density in toothbrushes. *J. Periodont. Res.* 7:346, 1972.
15. Robinson, H. B. G. and Kitchin, P. C. The effect of massage with the toothbrush on keratinization of the gingivae. *Oral Surg. Oral Med. Oral Path.* 1:1042, 1948.

16. Gjermo, P. and Flotra, L. The effect of different methods of interdental cleaning. *J. Periodont. Res.* 5:230, 1970.
17. Hill, H. C., Levi, P. A., and Glickman, I. The effects of waxed and unwaxed dental floss on interdental plaque accumulation and interdental gingival health. *J. Periodontol.* 44:411, 1973.
18. Radentz, W. H., Barnes, G. P., Carter, H. C., Ailor, J. E., and Jackson, R. M. An evaluation of two techniques of teaching proper dental flossing procedures. *J. Periodontol.* 44:177, 1973.
19. Bergenholtz, A. A., Hugoson, A., and Sohlberg, F. An evaluation of the plaque removing ability of some aids to oral hygiene. *Svensk. Tandlak. T.* 60:447, 1967.
20. Cohen, D. W., Stoller, N. H., Chace, R., and Laster, L. A comparison of bacterial plaque disclosants in periodontal disease. *J. Periodontol.* 43:333, 1972.
21. Schmid, M. O., Balmelli, O. P. and Saxer, U. P. Plaque removing effect of a toothbrush, dental floss, and a toothpick. *J. Clin. Periodontol.* 3:157, 1976.
22. Elliott, J. R., Bowers, G. M., Clemmor, B. A., and Rovelstad, G. A. II. A comparison of selected oral hygiene devices in dental plaque removal. *J. Periodontol.* 43:217, 1972.
23. Awwa, I. and Stallard, R. E. Periodontal prognosis: educational and psychological implications. *J. Periodontol.* 41:183, 1970.
24. Arnim, S. Thoughts concerning cause, pathogenesis, treatment and prevention of periodontal disease. *J. Periodontol.* 29:217, 1958.
25. Barrickman, R. W. and Penhall, O. J. Graphing indexes reduces plaque. *J. Am. Dent. Assoc.* 87:1404, 1973.
26. Chambers, D. W. and Allen, D. L. Computer analysis of oral hygiene habits. *J. Periodontol.* 44:505, 1973.
27. Derbyshire, J. C. Patient motivation in periodontics. *J. Periodontol.* 41:603, 1970.
28. Legler, D. W., Gilmore, R. W. and Stuart, G. C. Dental education of disadvantaged adult patients: effects on dental knowledge and oral health. *J. Periodontol.* 42:565, 1971.
29. Weisenberg, M. Behavioral motivation. *J. Periodontol.* 44:489, 1973.
30. Thornburg, H. D. and Thornburg, E. How to motivate patients to care. *Dent. Survey* 51:36, 1975.
31. Heifetz, S. B., Bagramian, R. A., Suomi, J. D., and Segreto, V. A. Programs for the mass control of plaque; an appraisal. *J. Public Health Dent.* 33:91, 1973.

32. Gravelle, H. R., Shackelford, M. F., and Lovett, J. F. The oral hygiene of high school students as affected by three different educational programs. *J. Public Health Dent.* 27:91, 1967.
33. Holmes, C. B. Changes in the status of oral health and its practice following a program of dental health education. *J. Public Health Dent.* 26:220, 1966.
34. Lightner, L. M., O'Leary, T. J., Drake, R. B., Crump, P. P. and Allen, M. F. Preventive periodontic treatment procedures: results over 46 months. *J. Periodontol.* 42:555, 1971.
35. Suomi, J. D., Greene, J. C., Vermillion, J. R., Chang, J. J., and Leatherwood, E. C. The effect of controlled oral hygiene procedures on the progression of periodontal disease in adults: results after third and final year. *J. Periodontol.* 42:152, 1971.
36. Suomi, J. D., Leatherwood, E. C. and Chang, J. J. A follow-up study of former participants in a controlled oral hygiene study. *J. Periodontol.* 44:662, 1973.
37. Smith, L. W., Evans, R. I., Suomi, J. D., et al. Teachers as models in programs for school dental health: an evaluation of the "The Toothkeeper." *J. Public Health Dent.* 35:75, 1975.
38. Ainamo, J. and Holinberg, S. A retrospective longitudinal study of caries prevalence during and 7 years after free dental care at school in Finland. *Community Dent. Oral Epidemiol.* 1:30, 1973.
39. Tucker, G. J., Andlaw, R. J., and Burchell, C. K. The relationship between oral hygiene and dental caries incidence in 11-year-old children. *Brit. Dent. J.* 141:75, 1976.
40. Silverstein, S., Gold, S., Heilbron, D., Nelms, D., and Wycoff, S. Effect of supervised deplaqueing in dental caries, gingivitis, and plaque. *J. Dent. Res.* 56:Special Issue A85 (IADR Abstract No. 169), 1977.
41. Horowitz, A. M., Suomi, J. D., Peterson, J. K., and Lyman, B. A. Effect of supervised daily plaque removal by children: results after third and final year. *J. Dent. Res.* 56:Special Issue A85 (IADR Abstract No. 170), 1977.
42. Keene, H. J. Plaque control: Science or science fiction? In: Keene, H. J., Wirthlin, M. R. and Glazer, S. A. (eds.) Conference on Navy Plaque Control Program March 1975, NDRI 75-08, July 1975.
43. Watson, W. J. Preventive dentistry in the U.S. Navy: A chronology of events. In: Keene, H. J., Wirthlin, M. R., Glazer, S. A. (eds.) Conference on Navy Plaque Control Program March 1975, NDRI-PR 75-08, July 1975.
44. Department of the Navy, Bureau of Medicine and Surgery, Manual of the Medical Department, NAVMED P-117. Washington. U.S. Government Printing Office, Chapter 6, Art. 6-102A.

45. Counsell, L. A. and Scheiner, E. F. A comparison of the social persuasiveness of three conventional modes of dental health education. NDRI-PR 72-02, May 1972.
46. Shiller, W. R. and Dittmer, J. C. An evaluation of some current oral hygiene motivation methods. J. Periodontol. 39:83, 1968.
47. Elliott, J. R., Bowers, G. M., Clemmer, B. A. and Rovelstad, G. A. III. Evaluation of an oral physiotherapy center in the reduction of bacterial plaque and periodontal disease. J. Periodontol. 43:221, 1972.
48. Scola, F. P. and Ostrom, C. A. Clinical evaluation of stannous fluoride when used as a constituent of a compatible prophylactic paste, as a topical solution, and in a dentifrice in naval personnel. II. Report of findings after two years. J. Am. Dent. Assoc. 77:594, 1968.
49. Oral Health Surveys Basic Methods, World Health Organization, Geneva, 1971.
50. Grossman, F. D. and Fedi, P. F. Navy periodontal screening examination. J. Am. Soc. Prev. Dent. 3:41, 1973.
51. Ennever, J., Sturzenberger, O. P. and Radike, A. W. The calculus surface index method for scoring clinical calculus studies. J. Periodontol. 32:54, 1961.
52. Wirthlin, M. R., et al. The health of naval recruits: periodontal diseases. Naval Dental Research Institute. NDRI-PR 79-04, July 1979.
53. Department of the Navy, Bureau of Medicine and Surgery. Preventive Dentistry and its Practice in the Navy. NAVEDTRA 10688; Washington, D. C., U.S. Government Printing Office, 1973.
54. Department of the Navy, Bureau of Medicine and Surgery. Preventive Dentistry. NAVMED P-5087, Washington, D. C., 1973.
55. Pipe, P., Ratcliff, P. A., Watts, T. and Parr, R. W. Developing a Plaque Control Program. Daly City, California, Praxis Publ. Co., 1972.
56. Shieham, A. A review of methods of prevention and control of periodontal disease. Internat. Conference-Workshop on Research in the Biology of Periodontal Disease, Univ. Illinois, June 1977.
57. Shklair, I. L., Keene, H. J. and Cullen, P. The distribution of Streptococcus mutans on the teeth of two groups of naval recruits. Arch. Oral Biol. 19:199, 1974.
58. Massler, M., Schour, I., and Chopra, B. Occurrence of gingivitis in suburban Chicago school children. J. Periodontol. 21:146, 1950.
59. Bibby, B. G. Do we tell the truth about preventing caries? J. Dent. Child. 33:269, 1966.

TABLE 1

DENTAL CARIES EXPERIENCE* OF SERVICE SCHOOL GRADUATES AT
GREAT LAKES, 1975-1978, SIX MONTHS INTERVAL
EXAMINATION 1 TO EXAMINATION 5

Index	Exam 1	Exam 5
DMFT	10.7	11.4
DS	8.0	5.1
MS	2.2	2.7
FS	11.9	16.2
DMFS	21.1	23.8

*Mean.

TABLE 2

PERIODONTAL DISEASES STATUS* OF SERVICE SCHOOL GRADUATES AT
GREAT LAKES, 1975-1978, SIX MONTHS INTERVAL EXAMINATION
1 TO EXAMINATION 5, NAVY PERIODONTAL SCREENING
EXAMINATION (NPSE)

Index	Exam 1	Exam 5
<u>Navy Periodontal Disease Index (NPDI)</u>		
Gingival Total (0-12 scale)	11.0	10.9
Pocket Total (0-48 scale)	7.0	5.7†
Score for "worst" tooth (0-10 scale)	5.8	5.4†
Total for all six teeth (0-60 scale)	17.9	16.5†
<u>Navy Plaque Index (NPI)</u>		
Score for "worst tooth (0-18 scale)	16.6	16.3†
Total for all six teeth (0-108 scale)	85.9	82.4†
<u>Calculus Surface Index (CSI)</u>		
Total for all six teeth (0-24 scale)	7.9	7.1†

*Mean

†Significant

TABLE 3

PERIODONTAL DISEASES STATUS OF SERVICE SCHOOL GRADUATES AT GREAT LAKES,
1975-1978, SIX MONTHS INTERVAL EXAMINATION 1 TO EXAMINATION 5
CLINICAL DIAGNOSES AND TREATMENT NEEDS (CASE TYPES)

	Exam 1		Exam 5	
	N	%	N	%
<u>Clinical Diagnosis†</u>				
Generalized chronic periodontitis	0	0	0	0
Gingivitis with localized periodontitis	10	2.8	3	0.8
Generalized chronic marginal gingivitis	214	60.6	213	60.4
Localized chronic marginal gingivitis	128	36.3	134	38.0
Generalized chronic papillary gingivitis	1	0.3	0	0
Localized chronic papillary gingivitis	0	0	3	0.8
Healthy gingivae	0	0	0	0
<u>Treatment Needs††</u>				
Case Type IV (PCI, PRO, Pdt Scl, Gvcty, POT)	10	2.8	6	1.7
Case Type III (PCI, PRO, Pdt Scl)	258	73.1	236	66.8
Case Type II (PCI, PRO)	82	23.2	104	29.5
Case Type I (PCI)	3	0.8	7	2.0

†In the group, 48 became worse, 242 stayed the same, 63 improved; $\chi^2 = 50.83$
p < 0.05.

††In the group, 42 became worse, 243 stayed the same, 68 improved; $\chi^2 = 17.88$
p < 0.05.

TABLE 4

PERCENTAGE CHANGES IN PERIODONTAL INDICES WITH INCREASING
EXPOSURE TO THE PLAQUE CONTROL PROGRAM

Treatment Group	Number of Subjects	Plaque NPI	Calculus CSI	Gingival GT	Pocket PT
<u>One SnF₂ Tx</u>					
1 PCI	62	-4.9*	-3.2	-0.9	-13.2
2 PCI	68	-1.3	-15.5	+2.6	-15.0
>3 PCI	28	-0.7	-19.4*	-5.0*	-15.4
<u>Two SnF₂ Tx</u>					
2 PCI	75	-5.0*	-12.6*	-1.1	-30.0*
3 PCI	73	-2.4	+2.7	-1.9	-20.8
>4 PCI	43	-8.8*	-19.4*	-4.3	-6.6

*Significant (p < 0.05) improvement (-) compared to baseline.

TABLE 5
EFFECT ON CARIES ATTACK RATES WITH INCREASING
EXPOSURE TO PLAQUE CONTROL PROGRAM

Treatment Group	Number of Subjects	Overall	Posterior Proximal
<u>One SnF₂ Tx</u>			
1 PCI	61	1.6%	4.4%
2 PCI	67	2.1	4.3
>3 PCI	20	2.5	2.9
<u>Two SnF₂ Tx</u>			
2 PCI	75	1.8	3.6
3 PCI	73	4.5	5.2
>4 PCI	43	2.3	4.0

TABLE 6
PERCENTAGE CHANGES IN PERIODONTAL INDICES WITH INCREASING EXPOSURE
TO GROUP AND INDIVIDUAL HYGIENE INSTRUCTION MODES

Treatment Group	Number of Subjects	Plaque NPI	Calculus CSI	Gingival GT	Pocket PT
1 G, 0 I	64	-4.3*	-0.3	-0.8	-12.4
1 G, 1 I	27	-0.6	-17.0*	-5.4*	-3.0
2 G, 0 I	118	-3.5*	-12.9*	-0.5	-29.5*
2 G, >1 I	72	-4.9*	-18.1*	-6.4*	-18.7*
3 G, 0 I	34	-3.7	-18.1	-3.1	-24.4
3 G, >1 I	21	-4.6	-9.6	-0.9	-8.6

*Significant (p < 0.05) improvement (-) compared to baseline.

TABLE 7

DENTAL SERVICE PROCEDURES, NEEDS AND ACCOMPLISHMENTS FOR NAVAL
RECRUITS AND SERVICE STUDENTS OVER SIX MONTHS

Treatment Group	Number of Subjects	Projected Treatment Exam 1	Dental Procedures Accomplished	Projected Treatment Exam 5
<u>One SnF₂ Tx</u>				
1 PCI	61	27.6	12.8	16.2
2 PCI	67	27.9	15.6	15.4
>3 PCI	20	35.8	26.4	15.3
<u>Two SnF₂ Tx</u>				
2 PCI	75	28.0	17.4	14.4
3 PCI	73	28.9	20.9	13.1
>4 PCI	43	33.2	29.8	14.5

TABLE 8

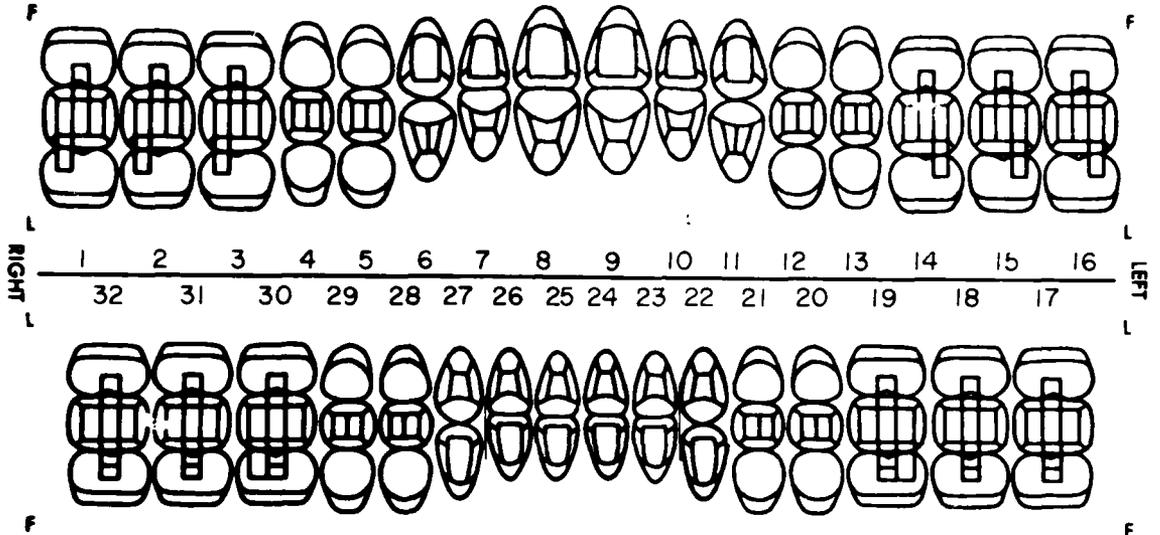
DISTRIBUTION OF NPI PLAQUE DEPOSITS (%) IN SUBJECTS
EXPOSED TO NAVY PLAQUE CONTROL PROGRAM

Tooth	Facial				Lingual				Occlusal O
	M	G	D	R	M	G	D	R	
<u>Before</u>									
3	93	69	99	59	100	44	100	25	39
9	87	35	88	17	98	36	99	39	1
12	79	41	95	14	96	25	98	1	53
19	94	59	99	30	100	94	99	14	42
25	98	58	98	17	98	92	99	52	0
28	90	41	97	9	100	95	99	23	83
<u>After 6 months</u>									
3	88	66	99	63	99	45	99	24	28
9	76	26	80	12	96	35	96	35	1
12	71	31	90	17	95	19	100	0	40
19	91	46	99	24	99	90	99	12	26
25	95	46	96	16	100	88	100	58	1
28	84	34	93	9	99	89	100	21	85

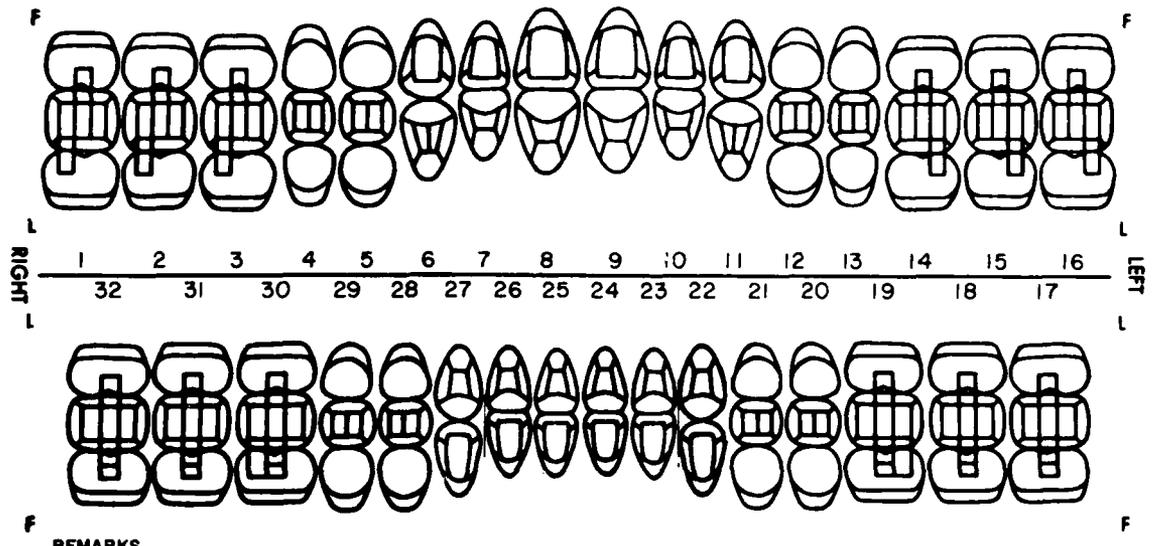
HEALTH RECORD	DENTAL
---------------	--------

SECTION I. DENTAL EXAMINATION

MISSING TEETH AND EXISTING RESTORATIONS



DESEASES, ABNORMALITIES, AND X-RAYS



REMARKS

NAME	DATE	DR CODE	EXAM CODE	
------	------	---------	-----------	--

9ND-NRDC-16979-5-73

Figure 1. Examination record for decayed, missing, and filled teeth.

NAVY PERIODONTAL SCREENING EXAMINATION
 NAVMED 6800/4 (Rev. 12/72) S/N 57A 0106-11-210-0001

Prepare ORIGINAL ONLY
 File in DENTAL FOLDER, D0723-1

PART I - NAVY PERIODONTAL DISEASE INDEX

INSTRUCTION

For each tooth examined, record score on the adjacent chart as follows:

- Obtain** GINGIVAL SCORE and enter figure in gingival score column.
- Obtain** POCKET SCORE and enter figure in pocket score column.
- Add** GINGIVAL SCORE to POCKET SCORE and enter sum in TOOTH SCORE column.

To amend chart: If the tooth designated on the chart is missing, strike through indicated number and insert substituted tooth number beside it. If 3, 12, 19, or 28 is missing, substitute the next most posterior tooth. If 9 or 25 is missing, substitute the nearest incisor in the arch; or where all incisors are missing from the arch, substitute a cuspid.

To determine GINGIVAL and/or POCKET score:

- Gingival Score** (Dry tissues around tooth before scoring)
- 0** Gingival tissue is normal in color and tightly adapted to the tooth—tissue is firm and no exudate is present.
 - 1** Inflammatory changes are present, but do not completely encircle the tooth. Changes may include one or a combination of the following:
 - Any change from normal gingival color
 - Loss of normal density and consistency
 - Slight enlargement or blunting of the papilla or gingiva
 - Tendency to bleed upon palpation or probing
 - 2** Inflammatory changes listed above completely encircle the tooth.
- Pocket Score** With calibrated periodontal probe take six measurements of each designated tooth—mesial, middle, and distal areas of the facial and lingual surfaces. The greatest single measurement determines the Pocket Score for the tooth.
- 0** Probing reveals sulcular depth not over 3 mm.
 - 5** Probing reveals pocket depth greater than 3 mm, but not over 5 mm.
 - 8** Probing reveals pocket depth greater than 5 mm.

DIAGNOSTIC AND TREATMENT RECOMMENDATIONS:

NPDI SCORE of 0 to 2: Oral prophylaxis, cariostatic agents, plaque control instruction.

NPDI SCORE of 5 to 7: Complete oral examination, periodontal treatment, cariostatic agents, plaque control instruction by general practitioner.

NPDI SCORE of 8 to 10: Complete oral examination, periodontal treatment; initiated by general practitioner, with possible referral to periodontist.

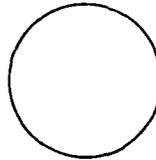
TOOTH NO.	GINGIVAL SCORE	POCKET SCORE	TOOTH SCORE
3			
9			
12			
19			
25			
28			

TOTAL SCORE FOR ALL TEETH _____

- HG= healthy gingivae
- LPG= loc. pap. gvtis.
- GPC= gen. pap. gvtis.
- LMG= loc. marg. gvtis.
- GMG= gen. marg. gvtis.
- LAG= loc. pdtis.
- GAG= gen. pdtis.

NPDI SCORE Record in circle highest score for any one tooth.

NPDI TOTAL Record in square total score for all teeth.

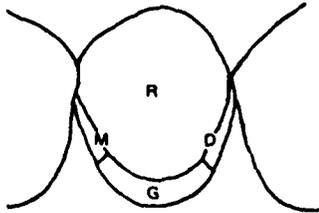


PLACE OF EXAMINATION		EXAMINER		DATE
PATIENT IDENTIFICATION				
SEX	GRADE, RATE, OR POSITION	ORGANIZATION UNIT	COMPONENT OR BRANCH	SERVICE, DEPT., OR AGENCY
PATIENT'S LAST NAME—FIRST NAME—MIDDLE NAME			DATE OF BIRTH (Day-Month-Year)	SOCIAL SECURITY NO.

Figure 2. Examination record and criteria for the Navy Periodontal Disease Index, with addition of chronic periodontal disease diagnostic category.

PART II - NAVY PLAQUE INDEX

Diagram of surface areas:
M-mesial; *G*-gingival; *D*-
 distal; and *R*-remaining



INSTRUCTION

For each tooth examined, record score on adjacent chart as follows:

Circle **M**
3

If you find plaque in contact with gingival tissue on *mesial* proximal surface.

Circle **G**
2

If you find plaque in contact with gingival tissue on *facial* or *lingual* surface.

Circle **D**
3

If you find plaque in contact with gingival tissue on *distal* proximal surface.

Circle **R**
1

If you find plaque on *facial* or *lingual* surface that is not in contact with gingival tissue.

Add Encircled numbers for each tooth, and record in **TOOTH SCORE** column.

Enter Highest score for any one tooth in **NPI SCORE** circle.

To complete the chart, total score for all teeth, and enter sum in **NPI TOTAL** square.

To amend chart: If the tooth designated on the chart is *missing*, strike through indicated number and insert substitute tooth number beside it. If **3**, **12**, **19**, or **28** is missing, substitute the next most posterior tooth. If **9** or **25** is missing, substitute the nearest incisor in the arch, or where all incisors are missing from the arch, substitute a cuspid.

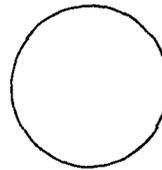
CHART FOR RECORDING PLAQUE FORMATION

TOOTH NO.	FACIAL				LINGUAL				TOOTH SCORE	
	M	G	D	R	M	G	D	R		
3	M 3	G 2	D 3	R 1	M 3	G 2	D 3	R 1	OCCL	01
9	M 3	G 2	D 3	R 1	M 3	G 2	D 3	R 1		01
12	M 3	G 2	D 3	R 1	M 3	G 2	D 3	R 1		01
19	M 3	G 2	D 3	R 1	M 3	G 2	D 3	R 1		01
25	M 3	G 2	D 3	R 1	M 3	G 2	D 3	R 1		01
28	M 3	G 2	D 3	R 1	M 3	G 2	D 3	R 1		01

TOTAL SCORE FOR ALL TEETH _____

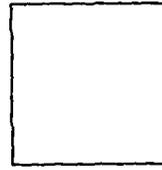
NPI SCORE

Record in circle highest score for any one tooth.



NPI TOTAL

Record in square total score for all teeth.



CALCULUS SURFACE INDEX:

3	M	F	D	L	_____
9	M	F	D	L	_____
12	M	F	D	L	_____
19	M	F	D	L	_____
25	M	F	D	L	_____
28	M	F	D	L	_____
TOTAL					_____

PLACE OF EXAMINATION				EXAMINER		DATE
PATIENT IDENTIFICATION						
SEX	GRADE, RATE, OR POSITION	ORGANIZATION UNIT	COMPONENT OR BRANCH	SERVICE, DEPT., OR AGENCY		
PATIENT'S LAST NAME-FIRST NAME-MIDDLE NAME			DATE OF BIRTH (Day-Month-Year)	SOCIAL SECURITY NO.		

Figure 3. Examination record and criteria for the Navy Plaque Index, with addition of occlusal plaque and Calculus Surface Index (modified) record.

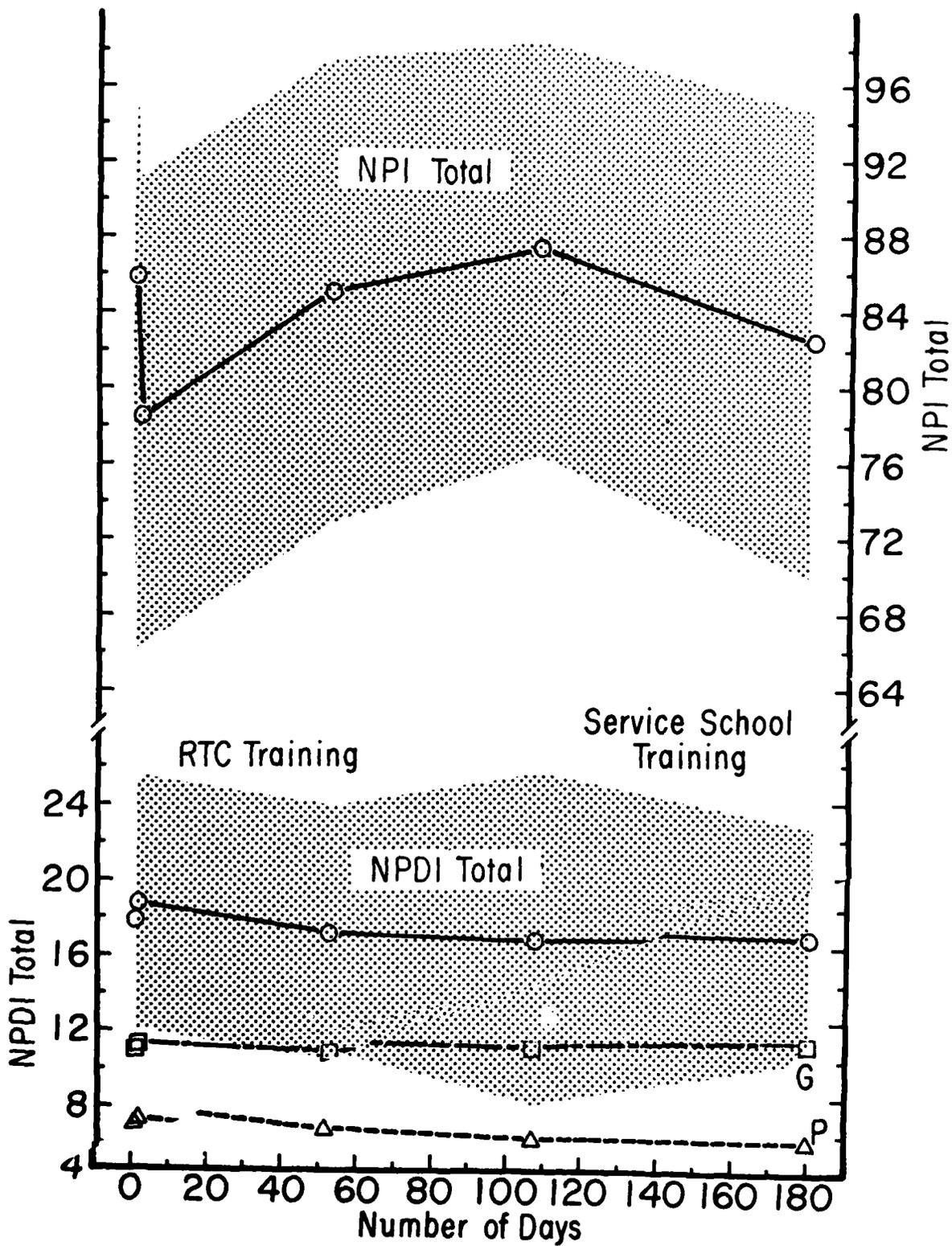


Figure 4. Changes in plaque and periodontal indices observed in naval recruits with five serial examinations over six months.

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
	AD-A086454	7
4. TITLE (and Subtitle)	5. TYPE OF REPORT & PERIOD COVERED	
6. EVALUATION OF THE NAVY PLAQUE CONTROL PROGRAM, AT GREAT LAKES.		
7. AUTHOR(s)	6. PERFORMING ORG. REPORT NUMBER	
M. B. WIRTHLIN E. B. HANCOCK R. G. WALTER and J. C. CECIL	NDRI-PR-80-01	
	8. CONTRACT/GRANT NUMBER(s)	
9. PERFORMING ORGANIZATION NAME AND ADDRESS	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS	
Naval Dental Research Institute Naval Base, Bldg. 1-H Great Lakes, IL 60088	M0095 PN003-3015	
11. CONTROLLING OFFICE NAME AND ADDRESS	12. REPORT DATE	
Naval Medical Research and Development Command National Naval Medical Center Bethesda, MD 20014	FEB 1980	
	13. NUMBER OF PAGES	
	19	
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)	15. SECURITY CLASS. (of this report)	
Bureau of Medicine and Surgery Navy Department Washington, D. C. 20372	UNCLASSIFIED	
	15a. DECLASSIFICATION DOWNGRADING SCHEDULE	
16. DISTRIBUTION STATEMENT (of this Report)		
This document has been approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
This document has been approved for public release; distribution unlimited.		
18. SUPPLEMENTARY NOTES		
16 M0095PN		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number)		
Preventive dentistry Periodontal diseases Dental caries Plaque control		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number)		
A review of before/after changes in dental plaque and calculus deposits and the distribution and severity of periodontal diseases in subjects at a naval training center was conducted, and related to the preventive dentistry program. The subjects were naval recruits who continued training at the center for six months. They received significant short-term reductions of plaque and at the end of their training had an overall slight improvement in periodontal health as a result of the program.		

108450

DATE
FILMED
-88