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Submarine Base, New London, Conn

MEMORANDUM REPORT 63-14

ORAL HEALTH PROBLEMS OF SUBMARINE PERSONNEL AND SUGGESTED PROGRAM FOR THEIR MANAGEMENT

MR005.12-5220-1.03 10 December 1963

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GROTON, CONNECTICUT

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SUMMARY PAGE

THE PROBLEM

To review the past and survey the present oral problems of submarine personnel, and to suggest a program to provide more adequate underway care during patrols,--especially the extended patrols of FBM submarines.

FINDINGS

A review provides information concerning dental problems reported in 1471 patrol reports of World War II. For recent submarine patrols, a questionnaire revealed that dental emergencies reported by 71 submarines over a one-year period numbered 641. A table provides a breakdown of the type of dental difficulty occurring. Preventive measures suggested include: Stricter adherence to dental standards in acceptance of submarine candidates; adequate correction of deficiencies prior to patrols, a course of training for medical personnel in diagnosis and treatment of dental conditions, as well as certain additions to the present dental equipment carried on submarines.

APPLICATIONS

This report presents information which will be of assistance to personnel charged with the responsibility of providing adequate dental care for submarine crews.

ADMINISTRATIVE INFORMATION

This investigation was conducted as a part of Bureau of Medicine and Surgery Research Project MR005.12-5220-1 - Effect of the Stresses of Submarine Service on Oral Health. The present report is No. 3 on this Subtask, and was approved for publication in May of 1963. The material was presented at a meeting of the Americal Medical Association at Atlantic City, New Jersey, in June of 1963.

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ORAL HEALTH PROBLEMS OF SUBMARINE PERSONNEL* AND A SUGGESTED PROGRAM FOR THEIR MANAGEMENT

INTRODUCTION

Oral health problems of submarine crews disrupt the schedules and reduce the operating efficiency of submarines to a greater extent than is generally realized. Despite rigid dental standards for submarine personnel, toothaches, infections, and traumatic injuries of the oral structures continue to account for a considerable number of sick days during submarine patrols. Although oral health problems are rarely life and death matters, they interfere with duty functions and are a source of discomfort to the crew. Dental emergencies assume particular significance aboard operating submarines because of the limited treatment facilities and training of medical personnel responsible for their management. Also, the small complement aboard submarines does not justify the assignment of dental officers to these ships to provide professional dental care.

The purpose of this paper is to review oral health problems reported aboard operating submarines during World War II as well as those described in more recent patrol reports of both conventional diesel-powered and nuclear submarines. These problems will serve as a basis for a suggested program for their management.

The U.S. Navy's W.W. II diesel-powered submarine was essentially a surface craft with limited submerged operation capabilities. The crew of approximately 80 men lived under extremely crowded conditions. Heat, humidity, noxious fumes and gases, high carbon dioxide and reduced oxygen levels were frequent causes of crew discomfort. Sanitation facilities were inadequate and fresh water supply was limited. These ships engaged in independent war patrols for periods up to 3 months.

Oral Health Problems of W.W. II Submarine Personnel

The data for this report, relative to the oral health problems of W.W. II submariners, were obtained from a study of medical and dental problems recorded in 1471 W.W. II patrol reports (1). Although many dental problems were probably not entered in the above reports,

* The opinions or assertions in this presentation are the private ones of the author and are not to be construed as official or reflecting the views of the Navy Department or the Naval Service at large.

those that were provide evidence of the extent to which they contributed to the discomfort of the crews and to interference in ship operations.

The patrol reports indicated three major contributing factors to the oral health problems of W.W. II submarine personnel; first, because of war-time circumstances, many men reported for submarine duty in poor dental health; second, the dietary habits and poor personal hygiene practices of submariners were conductive to the development of oral health problems; and finally, traumatic injuries of the oral structures were sustained in connection with submarine operations.

Post-patrol dental examinations (2) of 2,363 men (30 submarine crews) indicated:

A. 31.0 per cent had active dental caries
B. 7.3 per cent needed extractions
C. 13.4 per cent had gingivitis
D. 1.2 per cent had Vincent's angina (necrotizing ulcerative gingivitis).

Twelve hundred and forty-three men (17 submarine crews) returning from war patrols were examined (3) aboard a submarine tender and they had almost twice the incidence of "bleeding gums" as compared to the personnel of the tender.

A dental officer (4) who went on a submarine war patrol to observe the situation under combat conditions reported the necessity for pre-patrol dental treatment for submariners because toothaches and oral tissue infections render them impotent as fighting men. He also reported an alarming susceptibility to dental diseases among the crew which he attributed to their high carbohydrate diet, frequent drinking of sweetened coffee, and poor oral hygiene practices.

W.W. II submariners were subject to traumatic injuries because of the hazardous nature of W.W. II submarine operations and from enemy action. Occasionally, these injuries involved oral structures specifically. "Several commanding officers commented upon the 'tooth shaking' qualities of the concussion" from enemy depth charge attacks. A typical report stated that "Following a severe depth charging, three officers and five firemen complained of sore mouths and gums---. Two men had fillings knocked out by the intensity of the depth charges,' (REDFISH #2)" (5).

In the medical study of the 1471 patrol reports, all medical problems were classified into 15 categories according to the official U.S.

Navy diagnostic nomenclature. Dental diseases ranked ninth in importance (6). However, in the above classification several dental diseases were included in other categories. When these were included in the dental category, oral health problems ranked seventh in importance. This modified classification of the medical problems is shown in Table I. The conditions included in the dental category are listed in Table II.

TABLE I - Comparative Standing of Reported Diseases and Conditions*

Diagnostic Title	Patrols	Cases	Sick Days
Comm. D.	400	2,187	1,071
Injuries	687	1,212	1,069
G.I. Tract	329	1,751	1,087
Skin	196	1,340	167
Infectious Type	248	374	621
G.U. Tract	171	338	307
Dental	110	338	100
E.E.N.T.	136	273	148
Misc.	65	712	12
C.N.S.	59	62	32
Motor System	21	27	83
Lungs	8	9	4
Cardiovascular	7	7	22
Poisonings	(**)	(**)	(**)
Cause Unknown	16	(**)	289
TOTAL	2,419	8,630	4,999

* From "Medical Study of the Experiences of Submariners as Reported in 1,471 Submarine Patrol Reports in World War II" by I.F. Duff.
** Unknown.

TABLE II - Dental Diseases

Diagnostic Title	Patrols	Cases	Sick Days
Toothache	50	85	68
Gingivitis (Unclassified)	14	52	2
Vincent's Angina (Necrotizing Ulcerative Gingivitis)	36	176	7
Ulcers (mouth)	3	7	20
Extraction	7	18	3
TOTAL	110	338	100

Although the above classification did not include injuries of oral structures, a review of individual patrol reports included in the medical study revealed a number of injuries in which they were involved. A total of seven cases of such injuries were reported by seven patrols and they included the fractures of ten teeth, the loss of four teeth, one lip laceration, and one mouth laceration. No jaw fractures were recorded. Since these injuries were usually associated with other traumatic problems, it was not possible to determine the number of sick days attributed to dental injuries.

Occasionally the log entries of medical problems did not provide enough information for their subsequent classification. Consequantly, it is reasonable to assume that some of the conditions listed as "sore throats", mumps, herpes, and cellulitis may have involved the oral structures or were extensions of oral inflammatory conditions or diseases.

Several patrol reports included comments regarding the equipment provided for the treatment of dental emergencies. One commanding officer recommended that submarines carry extraction forceps. Another report concerned the extraction of an abscessed tooth by a pharmacist's mate with forceps provided by the executive officer. Another reported an extraction performed by a pharmacist's mate with "a large pair of water pump pliers". Another reported dental operation was: "The pharmacist's mate handled two painful dental cases...in a very efficient manner... It was, however, a rather gruesome sight to see him working with a machinist's hand drill (SHAD No. 10, June 1945)" (7).

More recent patrol reports of oral health problems

The U.S. Navy's present submarine fleet is composed of conventional diesel-powered W.W.II types and the new nuclear-powered ships. The habitability of the conventional submarines has been improved somewhat over that previously described during W.W. II.

The advent of nuclear power for submarines has greatly increased their offensive and defensive capabilities and has introduced new considerations in regard to the welfare of the men serving aboard these ships. The nuclear-powered submarine is a true submersible, and the major restrictions to its practically unlimited undersea operational capabilities is the endurance of the human beings in the crew.

The habitability of the nuclear submarine is greatly improved over that of the W.W.II types. The living space has been increased 50 per cent per man for the 130 man crew. Radiation protection is excellent and atmosphere control facilities are generally regarded

as acceptable. Ventilation, lighting, and interior finishes and furnishings have been designed to create a pleasant environment. There is a generous fresh water supply, and sanitation facilities are satisfactory. Food supplies and preparation are comparable to that obtained in the best hotel restaurants.

Unfortunately, despite the many advantages provided for the modern submariner, he remains subject to routine medical and dental problems which may arise during the extended isolation periods brought about by the submarine's greatly expanded cruising capability. Nuclear submarines now operate for months, completely isolated from outside help. Consequently, it is necessary to modify the medical and dental programs, which had been designed for the crews of conventional submarines, to meet the needs of nuclear submarine operation conditions.

The new health protection program includes the permanent assignment of medical officers to the FBM submarines. Hospital corpsmen continue to provide underway medical and dental care aboard the conventional W.W. II ships and the attack-type nuclear submarines. The submarine initial outfitting list (I.O.L.) of medical supplies and equipment has been revised to provide facilities for the treatment of anticipated medical problems based upon the medical experiences of previous patrols.

To obtain information about dental emergencies recorded during recent submarine patrols, a questionnaire was distributed among operating submarines. The respondents indicated a total of 641 recorded dental emergencies aboard 71 submarines covering a one-year period. The reported dental conditions and number of cases are shown in Table III.

TABLE III - Dental Emergencies Recorded Aboard 71 Submarines During the Period 1 June 1959 Through 1 June 1960

Toothache	280
Bleeding and Sore Gums	150
Pericoronitis	100
Post-Extraction Pain or Bleeding	51
Temporary Fillings	23
Fractured Teeth	19
Periapical Abscess	5
Fractured Jaw	1
Other	12
TOTAL	641

A review of 32 FBM patrol reports provided enlightening information in regard to the dental conditions and treatment problems encountered during extended FBM patrols. Two of these reports are presented in full:

LT John H. Baker, MC USN states: "During the boat shakedown availability period, the entire ship's company had dental examinations and necessary treatment performed. Despite this, several cases developed which presented problems. Aside from the case described below (Case #8), there were five cases of mild to moderately severe toothache with no evidence of abscess. These cases were due to old (two years or more) leaking amalgam fillings. All responded to symptomatic treatment, but pain recurred periodically in all cases and was, at least, a constant source of annoyance for the individuals involved. Since the affected teeth were all molars, no attempt was made at extraction. In no situation was it feasible to remove the amalgam and replace it with a temporary filling.

In the interest of proper dental care for personnel in this class ship, a complete dental kit must be provided for future patrols. There are completely adequate facilities available for training the medical officer and hospital corpsmen of these ships in the home port. The off-ship period affords ample time. It is obvious that even complete dental examinations on all hands prior to each patrol does not solve the problem. There must be a capacity for better care during the deployment.

"Case #8: A 27 year old caucasian male Chief Pharmacists Mate presented early in the patrol complaining of 'toothaches'. He had an abscess of the first lower right pre-molar draining through the gum. He was placed on tetracycline, 500 mgm orally stat, and 250 mgm Q.I.D. for four days along with analgesics. The amalgam in the tooth was in poor condition. He improved rapidly and was pain free in seven days. Two weeks later the lower left first pre-molar caused intermittent pain which was controlled by analgesics. No drainage was noted in this case. Here again the amalgam was in poor condition. Both teeth continued pressure sensitive until the end of deployment, but were no longer painful at rest."

Similarly, LT Robert F. Jeffery, MC USNR reports: "There were several dental cases of note. A filling came out and was replaced with zinc oxide and eugenol. There were two cases of acute pulpitis. One responded to antibiotics and temporary filling of a small cavity. Another case had no caries in the involved tooth. Since the man did not respond to penicillin, and chloranphenicol, and the infection was spreading into a massive facial cellulitis, it was elected to enter and clean out the pulp from the involved tooth, the maxillary canine.

Makeshift equipment was organized. A metal drill was sterilized and an extremely unwieldy air-powered drill was used as the power source. Because of the angle of entrance necessitated by the unwieldly instrument, it was impossible to insert a broach for reaming of the pulp, and adequate draining did not result. It finally resolved using large doses of penicillin and chloramphenicol and continuous application of heat. The infection continued for four days, with toxicity marked. If one is to treat periapical acute inflammation in a tooth with no cavities, the need of adequate dental drilling tools on the IOL is apparent.

"Two cases of perimolar cellulitis responded rapidly to penicillin. It is interesting to note that in each of the cases of dental infection during this patrol, the individual had received adequate dental examination within the past month. Prophylactic dental care is not the final answer but a better trained medical department and better equipment is needed."

A summary of all the dental problems reported during the 32 FBM patrols is presented in Table IV.

TABLE IV - Dental Emergencies Recorded During 32 FBM Submarine Patrols

Toothache	23
Bleeding or Sore Gums	23
Temporary Filling	17
Pericoronitis	10
Extractions	6
Abscess	6
Post-Extraction Infection	3
Fractured Teeth	2
Other	5
TOTAL	95

The preceding reports indicate a need for additional training for submarine medical personnel in the management of dental emergencies and modification of the submarine IOL to include an adequate dental armamentarium.

Suggested Program for the Management of Oral Health Problems of Submarine Personnel

An adequate program for management of emergency oral health problems of submarine personnel should include:

1. Preventive measures to reduce the incidence of underway problems.
2. A course of training for medical personnel in the diagnosis and emergency treatment of those dental diseases and conditions, which have presented problems during previous submarine patrols.
3. Revision of the current submarine IOL to include a realistic dental armamentarium for the anticipated dental emergency procedures.

Preventive Measures for the Reduction of Underway Dental Problems

The incidence of underway dental problems can be reduced to a minimum through the application of several preventive measures. Strict adherence to established dental standards for Submarine School candidates will reduce the number of potential dental problems entering the submarine service. Pre-patrol examination of the crew and treatment of indicated dental defects at dental facilities will reduce the possibilities of underway dental emergencies. Treatment of carious lesions and the performance of indicated extractions will reduce the number of "toothache" cases and possible sequelae. Oral prophylactic treatments for the removal of subgingival calculus and other sources of local tissue irritation will reduce the number of soft tissue problems. The incidence of pericoronitis cases can be reduced by the prophylactic extraction of partially erupted, impacted mandibular third molars or by the removal of tissue flaps over those in good alignment. Finally, a dental education program conducted for Submarine School students and submarine personnel for the promotion of good dietary and oral hygiene practices should reduce their carries attack rates and oral soft tissue problems.

As health guardians of the crew, it is the responsibility of the submarine medical officers and the hospital corpsmen to assure that each man has complied with the recommended measures for the reduction of underway dental emergencies. The reward of a conscientious preventive program will be a marked reduction in underway problems.

Suggested Training Program

Unfortunately, all potential dental problems are not predictable, and despite the conscientious application of preventive measures, unpredictable dental emergencies continue to occur during submarine patrols. Consequently, it is necessary to provide a training program for the medical officers and hospital corpsmen for the diagnosis and treatment of dental problems and to provide essential background material for implementation of the recommended preventive program.

The training program should provide knowledge and understanding of dental terminology and clinical records. This information will enable the medical officers and corpsmen to determine the prophylactic treatment requirements for each member of the crew from a review of the individual dental records maintained aboard the submarine.

It is not within the scope of this paper to establish a complete course curriculum for the training program, but it should include presentation of:

1. The anatomy of the structures involved in the treatment procedures.
2. Diagnostic procedures for the differential diagnosis of pulp pathoses.
3. The etiology, diagnosis, and emergency treatment of dental caries and sequelae, inflammatory and infectious conditions of oral soft tissues, and traumatic injuries of dental structures.
4. Methods for the control of post extraction pain or hemorrhage.
5. A method for the reduction of a dislocated mandible.
6. Emergency methods for the reduction and fixation of simple jaw fractures.

For submarine medical officers aboard FBM submarines, it is deemed necessary on the basis of previously reported emergencies and problems relative to their treatment to include additional training in:

1. Local anaesthesia techniques for dental structures.
2. Simple extraction procedures.
3. Reduction and fixation methods for simple jaw fractures.
4. The use of a low-speed dental engine for establishing access to carious lesions or the dental pulp.

In addition to lectures covering the course material, it is suggested that laboratory training aids and clinical experience be included for the emergency procedures presented. The medical officers and hospital corpsmen could obtain the necessary practical clinical experience under the supervision of dental officers during off-patrol periods.

Preparation of a well-illustrated manual covering the emergency procedures presented in the training program would serve as useful reference material aboard submarines.

Suggested Additions to the IOL

The present IOL of dental supplies and equipment is adequate for

the treatment procedures provided by hospital corpsmen. For ships carrying medical officers, several additions to the IOL are suggested:

1. Universal maxillary and mandibular extraction forceps.
2. A satisfactory head lamp for better illumination of operative sites within the mouth.
3. A belt-driven, low speed, dental engine and handpiece and appropriate dental burs for the removal of faulty amalgam restorations to provide access for the placement of sedative fillings or for establishing access to the dental pulp.
4. Selected appliances for the reduction and fixation of simple jaw fractures.

Summary and Conclusion

A review of the past and present oral problems of submarine personnel has been presented. The reported problems aboard FBM submarines indicated a need for an improved program to provide adequate underway dental care during the extended FBM patrol periods characteristic of this type of submarine, and a suggested program has been presented to meet this need.

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1. Duff, I.F., Medical Study of the Experiences of Submariners as Recorded in 1,471 Submarine Patrol Reports in World War II. Bureau of Medicine and Surgery Report P-1295. Downgraded to UNCLASSIFIED per BuMed Notice 5510 of 2 June 1960.

2. Ibid. Page 41 (LT W. E. Covington).

3. Ibid. Page 41 (O.E. Van Der Aue and W.R. Cullen).

4. Ibid. Page 42 (LCDR W.B. Martin).

5. Ibid. Page 188.

6. Ibid. Page 8.

7. Ibid. Page 42.