ILLNESS IN PATIENTS FOLLOWING EXPOSURE TO DENTAL AEROSOLS*

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This well-planned study of the relationship of aerosols in dental operating rooms and the incidence of respiratory diseases did not produce the correlation which might be anticipated.

The production of microbial-laden aerosols during dental operations, particularly those employing high-speed instruments with water-coolant sprays, has been shown to cause marked increases in the concentrations of airborne microorganisms found in dental operating rooms.[4, 5, 6, 9] As a consequence, questions have been raised about the potential hazard to health which these aerosols may create as airborne infections of dental personnel, [4, 5, 8, 9] and dental patients.[1, 4, 8]

To date, the degree of risk experienced by dental personnel or patients from exposure to airborne microorganisms remains speculative. No studies have established a direct relationship yet between occurrence of an infection and the microorganisms found in the air of a dental operating room, and the epidemiology of airborne infection in such an environment virtually is unexplored.

Because acute respiratory disease represents one of the major factors which contributes to the man-hours lost from productive employment, it appears of interest to learn whether the dental operating room plays a significant role in the dissemination of such disease by airborne transmission. The purpose of the study about to be reported is to assess the effect, primarily on acute respiratory disease, in those patients exposed to dental aerosols in a clinical environment.

Method Employed

The method of study had to be retrospective since it covered a period of four years from January 1966 through December 1969. The population studied consisted of 388 recruits at the Great Lakes Naval Training Center. The experiemental group contained 263 individuals who received dental treatment during their nine-week period of training. The remaining 125 individuals, serving as the group of controls, had no dental treatment during this period other than the prophylaxis (with stannous fluoride) that all recruits receive during their first week of training. All subjects had been selected early for duty in Submarine Service Schools upon completion of the initial training as recruits. The distribution of the sample for the experimental group and the controls is shown in Tables 1 and 2.

The standard dental record for the Federal Services (SF603) was used to obtain the following information for each subject who received dental treatment: (1) number of visits for treatment, (2) time spent at each visit, and (3) the total time spent in receiving treatment. Only that time devoted to operative dentistry was recorded. Other treatment, such as prosthetic replacement or oral surgery, was infrequent, and not included

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Table 1

Distribution by Year and Quarter of Subjects Who Received Dental Treatment

Quarter	Year				Total
	1966	1967	1968	1969	
Jan-Mar	7	19	24	15	65
Apr-Jun	13	15	16	4	48
Jul-Sep	20	22	20	25	87
Oct-Dec	29	16	11	7	63
Total	69	72	71	51	263

Table 2

Distribution By Year and Quarter of Subjects Who Received No Dental Treatment

Quarter	Year				Total
	1966	1967	1968	1969	
Jan-Mar	5	5	11	16	37
Apr-Jun	3	5	16	11	35
Jul-Sep	4	8	22	7	41
Oct-Dec	1	8	3	0	12
Total	13	26	52	34	125

therefore. Nonoperative dental treatment may have been rendered in a clinic other than the one in which all operative dentistry was performed. The time spent in receiving dental treatment was determined by using a table of average times required for the various procedures in operative dentistry.

Medical histories for all of the subjects were obtained from the Naval Medical Research Unit, No. 4 (NAMRU-No. 4), at the Great Lakes Naval Training Center. The records maintained at NAMRU-No. 4 are coded for different classifications of disease. Those listed in Table 3, with examples, were selected to be included in the current study for determining a weighted score of illness for each subject. Scores for illness were derived solely from those episodes recorded in each individual's health record as a result of reporting to the dispensary for medical attention. The scores reflect frequency and intensity of disease, inasmuch as they were calculated as follows: a value of "two" was assigned for each recorded episode of illness; a value of "one" was added for each visit to the dispensary for medical attention, and for each visit when the patient was febrile (100° F. or greater); and a value of "three" was added for each episode which resulted in admission to the hospital. An episode was determined as having ended when an interval of at least seven days elapsed between visits to the dispensary for medical attention.

The distribution of subjects who received dental treatment is shown in Table 4 by number of visits, total time spent receiving treatment, and the longest single period of treatment. Scores for illness were correlated with the distributions for frequency in each category of time, and with the number of visits. Scores for illness in the treated and untreated groups also were arranged in a ranked contingency-table for the purpose of comparing the two groups.

Table 3

Classifications of Disease, with Examples, Included in This Study for the Determination of Subject-Illness Scores

Acute Respiratory Disease	Exudative Diseases	Pneumonia-Group
Viremia	Scarlet fever	Viral pneumonia
Cold	Strep sore throat	Pneumococcal pneumonia
Rhinitis	Sore throat	Pneumonia, specific
Sinusitis	Pharyngitis	Acute pneumonia
Laryngitis	Tonsillitis	Broncopneumonia
Influenza	Viral Syndrome	Pneumonia, unspecified
Upper respiratory infection		

Table 4

Distribution of Treated Subjests by Number of Visits, Total Treatment–time, and the Longest Visit

No. of Visits	No. of Subjects	Total Treatment Time (minutes)	No. of Subjects	Longest Visit (minutes)	No. of Subjects
1	42	15-55	37	25-30	5
2	50	60-90	43	35-40	48
3	39	95-125	32	45-50	110
4	52	130-160	38	55-60	42
5	29	165-195	36	65-70	35
6	21	200-230	26	75-80	10
7	13	235-265	16	85-90	5
8	10	270-300	13	95-100	3
9	4	305-335	10	> 100	5
10	2	340-370	7		Total 263
11	1	375-405	3		
	Total 263	> 405	2		
			Total 263		

Findings

Correlation of scores for illness with (1) number of visits for dental treatment, (2) total time of treatment, and (3) longest single-office visit yielded results which were not significant. Values for the correlation coefficients (r) were 0.09, 0.05, and 0.04 respectively. A relationship, accordingly, was not demonstrated between dental treatment and frequency or severity of the diseases included as parameters in this study.

Examination of the ranked contingency-table (Table 5) showed that approximately three-quarters of the treated group and one-half of the untreated group reported no illness; they, at least, did not appear at the dispensary during sick-call to get medical attention for any of the diseases used in this study for the calculation of scores on illness. The lowest possible score for illness by definition, had a value of "3" which indicated one visit to the dispensary. An illness-score of "4" indicated either two visits during one episode, or one visit when the subject was febrile.

Statistical analysis (two-sample rank-test) of the frequency-distribution of subjects in the ranked contingency-table showed that the treated group reported less illness (p

Table 5

Distribution of Subjects, by Number and Percent, for Illness-Scores in the Treated and Untreated Groups

Group		Illness Scores								
		0	3-4	5-6	7-8	9-10	11-12	13-14	15-16	17-18
Treated (263)	No.	199	31	15	8	6	0	0	3	1
	(%)	(76)	(12)	(6)	(3)	(2.3)	(0)	(0)	(1.1)	(<1)
Untreated (125)	No.	60	35	24	3	2	1	0	0	0
	(%)	(48)	(28)	(19)	(2.4)	(1.8)	(<1)	(0)	(0)	(0)

<0.01) than the untreated group. As may be noted in Table 5, the greatest incidence of reported disease occurred in the lower range of scores for illness. This table shows that 18 percent of the treated group reported illness in the range from three to six and 47 percent of the untreated group reported illness in the same range.

Dental treatment was started in the sixth week of the recruits' training, and almost all treatment was completed by the end of the seventh week. The number of subjects who reported illness prior to the sixth week, and those who reported illness from the sixth to the ninth week are shown in Table 6. The treated group had less reported illness during both periods ($p < 0.01$).

Table 6

Number of Subjects Ill Before and After the Time Dental Treatment Started, and Number Reporting No Illness During Both Periods

Group	Number Ill		Number Not Ill
	1st-5th Week	6th-9th Week	1st-9th Week
Treated (263)	61	3	199
Untreated (125)	54	11	60

Some Discussion

The men in the population studied predominantly were between 17 and 19 years of age, and they came from eastern sections of the United States. They had been selected for future training in Submarine Service Schools as a result of intelligence, achievement, and psychological testing. On these bases, they represented the top 15 percent of the population of recruits. A prime requisite for their training is that all carious teeth must be restored. The experimental group was comprised, therefore, of individuals who entered the service in need of varying amounts of dental treatment before they could qualify fully for future training. The controls consisted of individuals who required no dental work in order to qualify; their necessary dental treatment had been accomplished prior to entry into the Naval Service.

The specific aim of the current study was to ascertain, using retrospective information, whether exposure to microbial-laden aerosols in the dental operating room placed the patient in a situation of undue risk to his health. While the results of this study did not demonstrate a relationship between selected rported illnesses and the time spent in the dental operating room, they do not deny the possibility of acquiring an airborne

infection in such a setting. The data did indicate, on the other hand, that this environment constituted no greater risk for airborne transmission of certain diseases than did other social environments encountered by the recruit, for example, barracks, mess-hall, and classroom.

More research will be necessary before a meaningful factor of risk can be assigned to the possibility of a patient contracting an airborne disease in the dental operating room. The number of viable airborne microorganisms present at a given time is but one facet of the total problem. Other factors to be considered include the types and numbers of pathogens, immunological responses, virulence, ventilation, and the survival of microorganisms in aerosols. With respect to survival, it has been shown previously that stresses of aerosolization analogous to those in the dental situation, with abrupt changes from high-to-mid- or to low-range humidities, may have detrimental effects on certain bacteria.[3, 10]

Because the experimental group and the controls appeared homogeneous in many respects, the finding of more illness in the controls was unexpected, and cannot be explained by the data available. One may speculate that this result might have been produced by the different habits or patterns in the two groups of men seeking medical attention. Green[2] reports that socioeconomic status may play a significant role in determining the nature of an individual's behavior when seeking medical attention.

McNamara and his group reported in 1962 that only a small percent of upper respiratory disease, as detected in surveys of barracks by use of throat-swabs, serology, and interviews, will be reported at sick-call in a dispensary by the recruits.[7] It is possible that individuals in the controls who had a previous history of seeking routine dental care also were conditioned by their socioeconomic background to seek medical attention for minor health problems. As a result, they would report more frequently to a dispensary at sick-call than nonconditioned individuals. This possibility is suggested further by the ratio of reported illness between the treated and untreated groups in the lower range of score (Table 5). It also may be suggested that use of a method for detecting reporting phenomena should be considered in other studies of this nature.

Summary

A retrospective study has been undertaken to assess the effect of patients' exposure to dental aerosols. The population consisted of 388 Naval recruits, of whom 263 received dental treatment and 125 had no dental treatment. The frequency of dental visits and the time spent in receiving dental treatment were determined for each member of the experimental group, and weighted scores for illness were calculated for all subjects. Correlation of scores for illness and (1) number of visits for dental treatment, (2) total time of treatment, and (3) longest dental treatment yielded results that were not significant. There was no indication of a relationship between dental treatment and the diseases included as parameters in this study. Comparison of the treated and untreated groups showed significantly less reported illness in the treated group. This result might have been produced by different patterns of the experimental and control groups in seeking medical services and have been a function of their socioeconomic background.

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What Makes Aspirin Work?

Aspirin became a common household-word soon after it was developed in 1899. Today the population of the United States consumes about 30 million pounds or 42 billion tablets per year to lower the temperature of fever, to reduce the inflammation of arthritic joints, and to kill pain. It works, but after 72 years of research who knows how it works? Recently researchers at the Royal College of Surgeons in London gained a clue; aspirin seems to stop the production of prostaglandins from arachidonic acid, an unsaturated human fatty acid. The chemistry sounds complicated, but no prostaglandin, no pain and no inflamed joints. (Irving Bengelsdorf in the Ann Arbor News for August 23, 1971)

To Producing Services

We, in the United States are shifting out of an industrial to a post-industrial society—From production of goods to production of services. Glancing back for a moment, we produce far more food today with less than five percent of our work-force than we did in 1890 with more than 40 percent of it. We wanted more health services and more education and we wanted to live in cities. Now we are confronted with the necessity to adjust effectively to a situation in which more than half of the work-force is producing services while the balance struggles with the production of food, materials, and public utilities. Frustration over inability to improve our institutions at a desirable rate is just one outcome of change to a postindustrial society. (P. E. Haggerty in Science for August 20, 1971)
