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Many daily professional activities of the dentist are based upon the preparation, direct use and mechanical alteration (grinding) of dust producing minerals and Aerosolizable substances include, but are not limited to cements, plaster and dental stone, refractory investments and the filler constituents of irreversible hydrocolloid (alginate) impression materials.

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civilian counterpart. Presently, the degree of danger to which military dental personnel are exposed during the performance of routine duties is uncertain. However, until adequate assessment of the problem can be made, it is recommended that rigorous standards of personal, clinic and laboratory hygiene in the handling of dust producing and aerosolizable substances be maintained.

POTENTIAL HAZARDS IN MILITARY DENTAL PRACTICE

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POTENTIAL HAZARDS IN MILITARY DENTAL PRACTICE

During the past decade, concern over alteration of the environment resulting from industrialization has increased markedly. The enigma of industrial growth has been complicated, in turn, by a rapid increase in the world's population and by the threat of irreversible losses of essential natural resources. Fortunately, fears attendant to these problems have prompted broad interest in the development and implementation of new concepts and technology to enhance the capacity of man to prevent further deterioration of his environment. Likewise, considerable attention has been focused on the effects of environmental factors on the health of man and other forms of life.

Today, seemingly practical and enforceable standards for clean air and water as well as standards to insure the safety of foods, drugs and other items of commerce serve the public at large. Individuals engaged in occupations which present known environmental hazards are afforded protection by industrial safety and health standards of the Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor. Adherence to such standards should reduce substantially the morbidity and mortality attributed heretofore to exposure to toxic substances in the performance of high-risk jobs.

The practice of dentistry is not classified as high-risk. The dentist, however, in the discharge of routine professional tasks, is subjected to exposure to potentially hazardous substances. Obvious

risks encountered in dental practice have become foci of recent studies. Dangers associated with the inhalation of particulate matter (bacteria, viruses, enamel, dentin, calculus and amalgam) from microbial aerosols[1,2] produced during the use of high-speed rotary instruments have been addressed. Likewise, numerous investigations have been conducted to establish and to define acceptable limits for operating room levels of mercury vapor[3-5] and nitrous oxide.[6-8] Unfortunately, little attention has been paid to other potential hazards of seemingly equal magnitude.

Pathogenicity of the mineral components of dusts encountered in so-called high-risk occupations is well established.[9-17] Dust deposits found in normal functioning lungs and in the lungs of patients afflicted by pneumoconiosis fall into the following categories: (1) Mineral associated with silicosis; (2) asbestos and ferruginous bodies; and (3) extraneous mineral substances.

Types as well as configurations of mineral deposits found in lung tissues have been described by Berry et al.[18] Etiologic agents of silicosis appear to be quartz, mica and clay. Materials exhibiting characteristics of quartz may contain, in addition to silica (SiO_2), small amounts of potassium, aluminum, iron, magnesium and titanium. Sodium and carbon are found frequently with deposits of asbestos (principally silica) and iron-containing (ferruginous) bodies. Extraneous minerals other than beryllium, chromium and nickel associated with lung disease include silicon, magnesium, calcium, manganese and aluminum.

Many daily professional activities of the dentist are based upon the preparation, direct use and mechanical alteration (grinding) of dust producing minerals. Aerosolizable substances include, but are not limited to cements, plaster and dental stone, refractory investments and the filler constituents of irreversible hydrocolloid (alginate) impression materials.

Minerals encountered with alarming frequency in dental practice are listed in the Table. Compositional and physical characteristics of these materials parallel closely the features of minerals detected, isolated and identified in pneumoconiosis.[18]

Deposition of particulate matter within respiratory tissues is dependent upon physical parameters (size, density, configuration, etc.) as well as on physiological factors.[19] Airborne particles with diameters ranging from 50 to 100 μm exert inertial forces greater than the frictional forces of air. Therefore, particles of this size range behave ballistically. On the other hand, true aerosol-particles are less than 50 μm in diameter, are invisible and remain airborne for relatively long periods of time. Upon invasion of the respiratory system, practically all particles larger than 10 to 20 μm are trapped in the nasopharynx and expelled by ciliary action. However, particles in the 0.5 to 10-μm diameter range can be inhaled and deposited within the terminal bronchioli and alveoli of the lung. Probability of deposition and retention of 1 to 2 μm particles which enter the pulmonary region is high, whereas probability of deposition of small (<0.5-μm diameter) particles is minimum. Extremely small (<0.1-μm diameter) airborne particles can remain suspended indefinitely by

Brownian movement and diffusion forces. Particles of such size are not impinged in the lung when inhaled and therefore are not regarded as hazardous.

To date, the characteristics of aerosols resulting from routine clinical procedures such as the high-speed finishing (grinding) of silica-containing composite restoratives, the contouring of fused porcelain, the polishing of metals and plastics with agents that contain either silica or finely dispersed metallic oxides and the manipulation of other dust producing dental materials are unknown. It is likely, however, that in the use of common dental materials, the dentist faces inordinately frequent exposure to dangerous airborne particles.

The potential for inhalation of airborne toxic materials by the military dentist who practices in a group situation would appear to be greater than that of his civilian counterpart. Presently, the degree of danger to which military dental personnel are exposed during the performance of routine duties is uncertain. However, until adequate assessment of the problem can be made, it is recommended that rigorous standards of personal, clinic and laboratory hygiene in the handling of dust producing and aerosolizable substances be maintained.

HAZARDOUS MINERALS

Mineral	Formula	Source
Chrysotile	$H_4Mg_3Si_2O_9$	Asbestos ring liners
Diatomite	SiO_2	Irreversible hydrocolloid powders and tripoli
Cristobalite	SiO_2	Casting investments
Quartz	SiO_2	Casting investments
Sillimanite	Al_2SiO_5	Silicate cement powder
Andalousite	Al_2SiO_5	Silicate cement powder
Calcium sulfate	$CaSO_4$	Gypsum products
Orthoclase	$KAlSI_3O_8$	Veneering porcelain
Microcline	$KAlSi_3O_8$	Veneering porcelain
Albite	$NaAlSi_3O_8$	Veneering porcelain
Labradorite	$NaAlSi_3O_8$ and $CaAl_2Si_2O_8$	Veneering porcelain
Spinelles	ZnO, Al_2O_3	Cement powders
Metals	Be, Ni, Cr	Grindings from base metal casting alloys

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