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Airborne Microbial Contamination of Dental Units

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ABSTRACT

Background: *Occupational risk of dental personnel to microbial airborne contamination has been demonstrated through the increased prevalence of respiratory infections. The American Dental Association has suggested stringent protection for infectious agents present in dental aerosols.*

Materials and Methods: *Occupational exposure of dentists to airborne microbial and mycological contamination in various locations of a dental school was monitored by sampling of air in close vicinity of their breathing zone. This sampler drew air at a flow rate of 10 liters/minute and for a 2-hour period and blew it at a high speed through a narrow slit over a solid nutrient agar plate. Immediately after sampling, the plates were placed in an incubator and incubated aerobically for 2 days at 37^0C.*

Results: *The total bacterial counts in the air of dental surgery rooms and in non-surgery rooms without direct involvements with dental operations were in the range of 120-280 cfu/m^3 and 49-128 cfu/m^3 respectively. Pathogenic Streptococcus haemolyticus and opportunistic Staphylococcus species were found in some locations of dental surgery rooms.*

Conclusion: *There are no standards for acceptable levels of indoor air contamination with pathogenic microorganisms and since pathogenic Streptococcus haemolyticus and opportunistic Staphylococcus species were found in some areas of the dental school, the need for management of possible risk of infective hazards is recognized.* ***(Tanaffos 2008; 7(2): 54-57)***

Key words*: Infectious aerosols, Dental practice, Airborne microbial and mycological contamination*

INTRODUCTION

Research studies have demonstrated that infective hazards are present in dental practice, because many infections can be transmitted by blood or saliva through direct or indirect contact, droplets, aerosols, or contaminated instruments and equipments (1). All dental personnel including dentists, nurses, and hygienists are at risk from infectious agents. Previous seroepidemiological studies have confirmed these occupational hazards, showing higher concentrations of serum antigen and antibodies for hepatitis B (1-3), hepatitis C (4,5), and Legionella species (6), in dentists than in the population and also an increased prevalence of respiratory infections (7) as well as symptoms possibly related to aerosols and droplets in the air of their breathing zone at work (8).

Researchers have studied the bacterial contamination of air samples collected from dental offices and stated that infectious aerosols may be generated during dental practice, especially when high-speed hand dentistry tools are used without a high-volume evacuator (9-11). There are data that support the potential transmission of infectious diseases through inhalation of these aerosols (12).

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The potential air contamination of dental surgery offices by infectious aerosols has also been pointed out by the "Centers for Disease Control and Prevention in Atlanta", which recommends that all sources of blood contaminated splatter and aerosols be minimized with face masks, high velocity evacuation of air, and proper positioning of the patient (13).

The aim of this study was to assess the microbial and mycological concentration in air of close vicinity of dental operators during routine dental treatment.

MATERIALS AND METHODS

Sampling was done during the morning hours (8-12 AM) and all dental wards where supervisor and students were stationed were sampled. Air contamination was monitored in all parts of dental wards by using a slit-to-agar biological air sampler (Casella Air Bacteria Sampler MK II with Casella pump T 13692). This sampler drew air at a high speed through a narrow slit and blew it over a solid nutrient agar plate. The plate rotated at a uniform speed under the slit, and a complete rotation of the plate took 30 minutes. In each case, the air sampler was placed about 1.5 m from the patient's mouth at breathing level of dental personnel to calculate total counts of bacteria, fungi, Staphylococci, and Streptococci. The sampler was operated at airflow rate of 10 liters/minute and for a 2-hour period during the treatment at various sections of dental school. Immediately after sampling, the plates were placed in an incubator and incubated aerobically for 2 days at 37°C (14). The total numbers of colony forming units (CFUs) in the range of 30-300 were counted, and the data were expressed as the number of CFU per cubic meter of air sampled. Colonies were also differentiated as bacterial (15) or fungal species (16) according to their morphology and other criteria such as Gram stain and diagnostic tests.

RESULTS

The total bacterial counts in the air of dental surgery rooms and in non-surgery rooms without direct involvement with dental operations were in the range of 120-280 cfu/m^3 and 49-128 cfu/m^3, respectively (Tables 1 and 2).

Table1. Density of microbial concentration found in the air of dental surgery wards

Place of sampling	No. Bacterial Colonies / its species	No. of Fungus/its species
Pediatrics	200/ Bacillus cereus, Staphylococcus auricularis	1/NR
Pediatrics sterilization room	140/Bacillus Subtilis, Staphyloccocus epidermidis, Staphylococcous saprophyticus	1/ Rhizomucor
Orthodontics	280/ Staphloccocus auricularis, Staphyloccocus epidermidis	50/Aspergillus niger
Orthodontics sterilization room	200/ Staphyloccocus saprophyticus, Staphylococcus auricularis, Staphyloccocus epidermidis and bacillus subtilis	NR
Endodontics	162/ Staphyloccocus auricularis, micrococcus and bacillus cereus	2/ Rhizomucor
Operative dentistry	148/ Staphylococcus auricularis, Staphylococcous saprophyticus, Staphyloccocus aureus and bacillus cereus	1/ Aspergillus
Jaw and mouth surgery	120/ Staphyloccocus auricularis, Strepotococcus haemolyticus, Staphyloccocus saprophyticus, and Staphyloccocus epidermidis	10/ Penicillium
Periodontics	134/ Staphyloccocus saprophyticus, Staphylococcous aureus and Streptococcus haemolyticus	6/ Penicillium Aspergillus flavus
General dentistry	198/ Staphyloccocus auricularis, Staphylococcous aureus, Staphyloccocus epidermidis and bacillus subtilis	10/ Penicillium
Pathology	164/ Staphyloccocus epidermidis, Staphyloccocus auricularis, bacillus cereus and Staphyloccocus saprophyticus	NR

NR= Not reported

Table 2. Density of microbial concentration found in the air of areas outside the surgery rooms during sampling for two hours and 1.2m3

Place of sampling	No. Bacterial Colonies / its species	No. of Fungus/its species
Class room No.3	49/Bacillus subtilis and Staphyloccocus auricularis	4/Candida
Ambient air outside of dental school	73/ Bacillus subtilis, Staphyloccocus saprophyticus, Staphyloccocus auricularis , Staphyloccocus epidermidis	4/Candida
Compressor room	79/Staphyloccocus auricularis and bacillus cereus	1/Penicillium
Student cafeteria	128/Staphyloccocus epidermidis, Staphyloccocus auricularis, Staphyloccocus saprophyticus	NR

Staphylococcus bacteria were found in all areas of the dental school. The total fungi counts in the air of dental surgery rooms and in general rooms without direct involvement with dental operations were in the range of 1-50 cfu/m^3 and 1-4 cfu/$m^{3,}$ respectively.

DISCUSSION

In this study, the air samples of dental surgery rooms have been studied. The microbial density of indoor air was fairly high compared to nonpathogenic indoor air criteria (17). Staphylococcus species were found in indoor air of dental school and the active role of dentistry operations in microbial contamination of various parts of the dental school with or without direct involvement with dental operations was noticed. This could be due to the frequent use of devices with propelling force such as a high-speed dental drill combined with a water spray, which can generate numerous airborne infectious microbial agents. Transmission of infectious disease associated with indoor environments of dental clinics, could be acquired by dental staff and patients by airborne transmission (1-7). In addition, dental aerosols containing opportunistic pathogens should also be considered hazardous for immunosuppressed patients, who could develop serious infections (17). The mycological examination of dental bioaerosols showed presence of Penicillium species with allergenic properties, which, could also be found in cosmopolitan air in various climatic zones (18).

Microbial contamination of dental surgical areas in the range of 120-280 cfu/m3 is comparable to previous studies (19,20). There are some criteria for acceptable levels of indoor air. Nonpathogenic microorganisms and bacteria referred to are implicitly ambient or environmental bacteria. However, in regard to pathogenic bacteria and viruses, particularly contagious pathogens, there are no safe limits (21). Therefore, presence of pathogenic bacteria such as pathogenic *Streptococcus haemolyticus* and prevalent opportunistic Staphylococcus in dental surgery rooms is not acceptable.

According to the data presented for indoor microbial air contaminants in this study, there is a potential transmission route for infectious agents to be transmitted to dental personnel and the presented data support the importance of protection against cross-infectious agents present in dental aerosols. As suggested in the infection control guidelines of the "American Dental Association" (22), operators and dental assistants should always wear masks, gloves, and eyeglasses with lateral protective shields. A group of researchers have also recommended patients to rinse their mouth with an antiseptic solution (chlorhexidine gluconate) for reduction of the microbial contents of aerosols prior to dental surgery (23).

This research demonstrated the need for the management of possible risk of infective hazards among dental personnel in an Iranian dental school. Therefore, formal and informal educational programs along with performing periodic checks on

environmental contamination are recommended to improve the quality of dental surgery environments.

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