



Joseph Zeisler
BSc MSc DDS

Cleaner Air in the Dental Office

Introduction

SARS, tuberculosis, chicken pox and, most recently, the H1N1 (influenza) virus are some of the conditions that bring airborne transmission of disease to our attention again.

Indoor air quality (IAQ) and indoor pollution control have become the focus of a number of government agencies and organizations lately, as the effects of indoor particulate matter (PM) pollution on human health is becoming more evident with recent research.

Fine and ultrafine PM (less than 0.3 micrometer) which includes the bio-aerosol and virus particle size, was assumed to be exhaled with exhaled air, but in recent years it has become clear that these smallest molecules, capable of reaching the deepest parts of the lung, are absorbed into the blood stream and have systemic effects.

Indoor Pollution

Particulate matter (PM) can be either solid or liquid with aerodynamic diameters ranging from 0.005 to 100 micrometer.³

Solid PM includes viruses, bacteria, fungal spores, pollen, dusts, fumes and smoke. Liquid PM includes spatter drops, droplets, droplet nuclei, mists, fogs and aerosols.

In the dental office, ultrafine bio-aerosols which contain droplet nuclei are a particular threat because of their ability to transfer infectious disease.

Airborne transmission of infectious diseases is not the only threat from suspended PM.

Scientific studies have linked PM exposure to:

- increased airway problems (irritation, wheezing, coughing and difficulty breathing);
- decreased lung function and lung capacity (COPD);
- asthma, increased frequency of chronic bronchitis,
- blood coagulation problems (clot formation),
- heart problems (irregular heart and heart attacks): and
- deterioration of pre-existing lung and heart conditions resulting in premature deaths.^{4,5,6}

The Dental Environment

In most industries, the customer is not usually part of daily operations and production, and remains separate from the hazardous environment, equipment and materials. The dental office is unique in that both dentists and their patients share the same environment (air) during daily operations and all need to be protected against hazardous materials.

It is well-known that indoor air at home is usually more polluted than outdoor air by at least two- to five-fold, and can reach levels of up to 100-fold regardless of whether the home is in a rural or highly industrialized area.^{7,8}

Commercial office space is more polluted than the standard home indoor space because of increased traffic and office machine output. Dental

offices have the potential of being much more polluted because they are high-traffic commercial spaces and produce volatile organic compounds (VOCs) — compounds that contain carbon atoms in their molecules and can vaporize under normal (room) conditions and enter the atmosphere — from the dental materials and from the constant cleaning and disinfection of contact surfaces and dental instruments. Of a particular concern is the production of bio-aerosols (containing droplet nuclei), which have the potential to transfer infectious diseases.

These bio-aerosols are generated by:

- high- and low-speed drilling into tooth, bone and soft tissue;
- air-water syringe washing and drying
- sonic scalers and ultrasonic instrument cleaners.

Dental offices also produce very fine dusts resulting from cutting and abrasion of dental materials.

The cloud of bio-aerosols (containing bacteria and viruses) that form as a result of dental procedures can remain suspended in the air for hours. These bio-aerosols slowly fill the dental operatory air during the work day and settle, under gravitational pull, as a cloud, between floor level and a six-foot height level — the space occupied by dental staff and patients.

continued page 28

Compliance With Air Quality Legislation

Legislation exists for air purity in the work place for the protection of workers. Dentists also have a duty to protect the patient. The employer's general duty clause dictates that employees have the right to work in (and be provided with) a safe environment which includes a safe surrounding atmosphere.

The Occupational Health and Safety Act (OHSA) stipulates that a dentist as an employer and supervisor has a general duty to protect his or her employees and to "take every precaution reasonable in the circumstances for the protection of a worker".⁹

Regulation 851, under the OHSA – Industrial Hygiene Part III is specifically concerned with ventilation and replacement air for the protection of workers in the workplace. It states:

A. There has to be adequate ventilation by either natural or mechanical means such that the atmo-

sphere does not endanger the health and safety of workers.¹⁰

- B. The replacement air shall be free from contamination with any hazardous dust, vapor, smoke, fumes, mist or gas.¹¹
- C. The discharge of air from any exhaust system shall be in such a manner so as to prevent the return of contaminants into any workplace.¹²

Using An Air Cleaner

An efficient air cleaner will remove particulate matter from the air — including potentially infective droplet nuclei. This reduction (dilution) or complete elimination of viruses and bacteria breaks the cycle of airborne disease transmission, which may lead to infection.

It is important to choose an effective air cleaner based on the volume of space to be cleaned (it has to be fast enough to be practical for commercial

health care use) and the proven technology available in the marketplace.

What's In It For You – the Dentist?

Besides complying with the law, the dentist is making an effort to break the cycle of infection. The dentist is protecting everyone from the transfer of infection by keeping the levels of bio-aerosols down.

Staff and patients will soon recognize — and actually smell — the difference in the clean air and will appreciate the efforts of the dentist in creating a safe environment for everyone visiting and working in the dental office. 

Dr. Zeisler is a 1986 graduate from the University of Toronto's Faculty of Dentistry. He is currently R&D director for Health Control Systems Inc. He was previously a research scientist in molecular genetics and recombinant DNA technology. Dr. Zeisler may be contacted at 416-549-8007 or at info@healthcontrolsystems.com.

References

1. <http://www.who.int/csr/disease/swineflu/en/>
2. http://www.who.int/csr/disease/avian_influenza/country/en/
3. <http://www.hc-sc.gc.ca/ewh-semt/air/in/poll/particul/index-eng.php>
4. <http://www.epa.gov/air/particlepollution/health.html>
5. http://www.ec.gc.ca/Science/sandjulaug/article1_e.html
6. http://www.ec.gc.ca/cleanair-airpur/Indoor_Air_Pollution-WS1280FDA8-1_En.htm
7. The inside story: a guide to indoor air quality, us - epa, <http://www.epa.gov/iaq/pubs/insidest.html#Intro>
8. Basic information, us - epa, <http://www.epa.gov/air/basic.html>
9. The occupational health and safety act – R.R.O. 1990, section 25, subsection (2) (h).
10. The occupational health and safety act – R.R.O. 1990, Regulation 851, Industrial Establishments, Part III, Industrial Hygiene, section 127.
11. The occupational health and safety act – R.R.O. 1990, Regulation 851, Industrial Establishments, Part III, Industrial Hygiene, section 128, subsection (2) (b).
12. The occupational health and safety act – R.R.O. 1990, Regulation 851, Industrial Establishments, Part III, Industrial Hygiene, section 128, subsection (3).