Infection control has never been more essential
An update on practice hygiene measures and protocols

Dr Safura Baharin
Malaysia

Demand for dental treatment has been increasing in recent years as people have become more aware of their oral health and the benefits of good dental aesthetics. Maintaining and practising stringent cross-infection control procedures therefore have never been more essential to ensure the health and safety of dentists, dental hygienists and assistants, as well as other supporting staff who may be indirectly involved in the treatment process.

Dental professionals are at high risk of cross-infection. A report published in 1999 has shown that in developing countries, for example, the number of dental staff contaminated during treatment is increasing by almost 6 per cent each year.

Research has shown that infectious microorganisms can be transmitted by blood or saliva via direct or indirect contact, aerosols, or contaminated instruments and equipment. As stated by the US Centers for Disease Control and Prevention (CDC) in their 2003 guidelines, the transmission of infectious disease can occur in four ways: direct contact with blood or body fluids, indirect contact with contaminated objects or surfaces, contact with bacterial droplets or aerosols, and inhalation of airborne microorganisms.

The most likely mode of transmission in dentistry is through inhalation of bacterial aerosols or splatters. Their potential health hazards are well documented and acknowledged. Both can be host to a large variety of micro-organisms and viruses, which can be infectious to susceptible individuals. During treatment, the dentist’s face and patient’s chest are most affected by splatter, as the majority of the splatters are radiated towards them.

According to studies, the most contaminated area on the dentist’s face during treatment is around the nose and his or her inner corner of the eyes. Splatter consists of large particles of greater than 100 µm generated during the use of dental equipment, such as turbines, ultrasonic scalers, or water and air syringes. Owing to this, splatter tends to travel in a trajectory, thereby contacting objects in its path. Aerosol consists of smaller particles that can remain in the air for a long time and travel with air currents. Most dental aerosols are less than 5 µm in diameter; therefore, they are able to penetrate and stay within the lungs, causing respiratory or other health problems. Among dental procedures that produce high aerosol concentration are ultrasonic scaling, tooth preparation using high-speed handpieces, and dental extraction involving bone removal via a dental handpiece.

The World Health Organization (WHO) has reported a rise in airborne infections worldwide. Tuberculosis in particular has increased in the developing world (Tab. 1). It has been stipulated (Tab. 1) that the risk of exposure to tuberculosis in susceptible DHCP is higher than in healthy individuals. Bennett et al. concluded that dentists and their assistants, who are exposed for approximately 15 minutes during peak aerosol concentration, have a slightly higher risk of exposure to Mycobacterium tuberculosis than the general public does. During this period, the DHCP inhales about 0.014 to 0.12 µl of aerosolised saliva, which can contain viable pathogens that can have a detrimental effect on the health of susceptible DHCP.

With all of this in mind, it is the responsibility of DHCP to adhere strictly to recommended infection control guidelines and policies. Several measures should be taken to reduce and control airborne contamination in the dental clinic. For example, it has been demonstrated that the use of a mouthrinse, high-volume evacuation or a combination of both methods significantly reduces the number of colony-forming units in aerosols emitted during ultrasonic scaling. Routine use of rubber dam isolation provides a clean and dry area for placement of dental restorations.

### PPE

<table>
<thead>
<tr>
<th>Country</th>
<th>Estimated # of cases</th>
<th>Estimated rate (per 100,000 population)</th>
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</thead>
<tbody>
<tr>
<td>Pakistan</td>
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<td>251</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>350,000</td>
<td>225</td>
</tr>
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<td>Indonesia</td>
<td>65,000</td>
<td>165</td>
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<tr>
<td>Thailand</td>
<td>80,000</td>
<td>118</td>
</tr>
</tbody>
</table>

Table 1: Tuberculosis in Asia.

During treatment the most contaminated areas are around the dentist’s nose and his or her inner corner of the eyes.

### PPE Recommendations

**Surgical mask**
- Should cover both nose and mouth
- Change when wet (from sweating, sneezing, breathing or other contamination)
- Use particulate filter respirators (N95) when airborne isolation precautions are necessary (transmission-based precautions for patients with tuberculosis)

**Protective eyewear**
- Should be worn all the time
- Preferably with lateral protection that is wide enough to cover the eye
- Must be rinsed and disinfected when contaminated between patients

**Face shield/visor**
- Select a face visor with acceptable visual quality (clear, no reflection or refraction) and no fogging
- Splash or splatters generated during dental treatment, especially when using an ultrasonic scaler or high-speed handpiece, are concentrated towards the dentist’s face.
- Wearing a face shield also reduces the amount of splatter contaminating the face area.
- To protect the face from splatters and aerosols during dental procedures

**Gloves**
- Worn in contact with blood or body fluids
- Double gloving may reduce the risk of exposure to high-risk patients (HIV, hepatitis B or C virus)
- Should be worn for the duration of the dental treatment and changed between patients
- Hands must be washed before wearing gloves

**Protective clothing, such as gowns or jackets**
- Change daily or when visibly contaminated with blood or oral fluids
- Wash separately from domestic and non-medical clothing
- Preferably long sleeves with a tight cuff

### Rationale

- Splatters and aerosols may contain bacteria and viruses that can infect a susceptible person in the dental clinic.
- To protect dentists’ and assistants’ oral and nasal mucosa from blood and saliva a splatter shield is necessary (transmission-based precautions • Some of these micro-organisms are small enough to penetrate the mask and are then inhaled by the DHCP and infect the lungs. A special mask may therefore be needed (N95 and PFFP respirators).
- Splatters from dental procedures may come into contact with the conjunctiva and cause irritation or infection.
- Some materials used during dental treatment, such as sodium hypochlorite, may cause severe irritation and damage if accidentally splashed into the DHCP’s eyes or face.
- To protect the mucosa of the eyes from splatters
- To prevent transmission of infection from the patient to the DHCP and vice versa
- To prevent the contact of blood and saliva with the dentist’s hands
- To protect daily clothing from contamination from splatter or aerosols
- High occurrence of blood-contaminated splashing in the direction of the dentist during surgical procedures
- Areas commonly contaminated are the right forearm, abdomen and thorax

### Table 2: Recommendations and rationale concerning personal protective equipment.

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prevents salivary and blood splash, and protects the patient’s mouth and airway.

Using personal protective equipment (PPE), such as surgical masks (with at least 95 percent efficiency against particles 3 to 5 µm in diameter, changed for every patient or every 20 minutes in an aerosol environment or 60 minutes in a non-aerosol environment), safety glasses with lateral protection to prevent contact with eyes, as well as disposable gowns and gloves to reduce the penetration of or contact with bacterial aerosols and splatters, is vital (Tab. 2).

Regular maintenance of the air-conditioning system is recommended too, as good ventilation has a diluting effect on the airborne microbial load, especially at night when the clinic is closed. Air samples taken at different times at a multi-chair dental clinic showed that bacterial aerosols are more concentrated during treatment and that there is higher concentration of circulating bacterial aerosols at the beginning of the day, which may be related to reduced ventilation. Residual bacterial aerosols can be removed through air filters or ultraviolet light.

As splatters can travel as far as the door or supply counter in the middle of a multi-chair dental clinic, all clean, unused instruments and equipment should be kept in closed cabinets or drawers to prevent contamination.

Other important measures that must be taken to prevent cross-infection include adequate sterilisation of dental instruments, disinfection of work surfaces before and after each dental procedure, disinfection of all dental materials and work sent out to the laboratory, and regular maintenance of the dental water lines and equipment, which has the potential to harbour bacteria. All dental water lines should be purged at the beginning of each day for between 5 and 10 minutes and flushed thoroughly with water, as residual water may become contaminated overnight and biofilm may develop along the inner side of the tube. Purging will result in a significant decrease in bacterial counts.

The Canadian Dental Association recommends running high-speed handpieces for 20-30 seconds after each treatment to purge all potentially contaminated air and water. This procedure has been proven to reduce the bacterial load in the water line significantly. Blood cells, as well as bacterial and viral particles, can survive inside handpieces even after disinfection. They must therefore be sterilised between patients.

The clinic floor should be disinfected and cleaned with an antimicrobial disinfectant solution at least twice per day to eradicate any bacterial residue from splatter or aerosol splatters, and protects the patient’s mouth and airway.

High fluoride releasing
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Dentistry is not immune to threats posed by antibiotic resistance

Dr Sharon Liberali

The administrative aspects of dentistry continue to become more demanding with increasing amounts of time spent in fulfilling mandatory accreditation requirements. It can often feel overwhelming, taking us away from the clinical practice of dentistry, and there is a risk that, owing to high clinical demand, short-cuts may be taken.

However, infection control must be considered to be a central part of quality dental care. A purported commitment to high standards and the pursuit of clinical excellence is meaningless when low priority is given to quality issues in the field. Failure to address all infection control requirements increases the risk of disease transmission, ultimately compromising patient safety.

The importance of infection control in clinical dental practice simply cannot be understated. While the tasks associated with the decontamination and sterilisation processes of reusable instruments are now routine, consideration must be given to the less obvious components of infection control processes that can unwittingly compromise the health of our patients. Identifying when patients may potentially be infected with bacteria or viruses, how these bacteria or viruses may be transmitted in the health care setting, and when we need to apply transmission-based precautions are increasingly gaining significance.

The microbial threats facing us today pose significant health risks, and the situation is not likely to improve. The WHO’s first global report on antibiotic resistance1 was released on 30 April 2014. It has identified that highly resistant organisms are now commonplace, and that antibiotic resistance is a serious worldwide threat to public health. Dentistry is not immune to this.

Multi-resistant bacteria are primarily transmitted either by direct contact or indirectly via contaminated surfaces. Currently, the most problematical health care-associated multi-resistant organisms include those highlighted in the WHO report: methicillin-resistant Staphylococcus aureus (MRSA), Escherichia coli and carbapenemase-producing Gram-negative bacteria (e.g. Klebsiella pneumoniae).

Almost everything in a dental clinical setting can serve as a reservoir and/or a vector for opportunistic pathogenic organisms.

Three-dimensional illustration of an MRSA bacterium. (DTI/Photo courtesy of Michael Taylor)

As well as being important as a reservoir and/or a vector for opportunistic pathogenic organisms.

Almost everything in a dental clinical setting can serve as a reservoir and/or a vector for opportunistic pathogenic organisms.

This includes, but is not limited to, work surfaces, computer keyboards, the hands of health care workers, and dental equipment and/or devices. Surfaces in particular play a significant role in the acquisition, persistence and spread of infections.

Clinically important micro-organisms that can cause health care-acquired infections have been shown to persist in every health care environment for considerable periods. This facilitates the spread of the organism throughout a health care facility, including the dental setting, especially when patients with multi-resistant organisms are not identified, and compliance with hand hygiene and surface cleaning or disinfection is poor.

The WHO’s report highlighted that health care workers can help tackle antibiotic resistance by enhancing infection prevention and control. Every member of the dental team must follow the standard procedures required to prevent the transmission of micro-organisms, including hand hygiene, personal barrier protection, instrument disinfection and sterilisation protocols, as well as surface decontamination strategies. Work surfaces in the dental operatory that are in the contaminated zone must be cleaned after every patient by wiping the surface with a neutral detergent, while work surfaces outside the contaminated zone must be cleaned after each session or when they become visibly soiled. The dental team should be fully aware of the risk of dissemination of potentially hazardous micro-organisms and ensure that efficient cross-infection control procedures are properly maintained.

Contact Info

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Almost everything in a dental clinical setting can serve as a reservoir and/or a vector for opportunistic pathogenic organisms.

Viruses from the respiratory tract (e.g. the influenza virus) can persist on surfaces for several days, while blood-borne viruses (e.g. hepatitis B virus and HIV) can persist for more than one week. Herpes viruses (e.g. herpes simplex virus Types I and II) commonly encountered in the dental office can persist on surfaces anywhere from a few hours to as long as seven days. Bacteria can persist for much longer. Most Gram-positive bacteria (e.g. MRSA) can survive for months on dry surfaces, and many Gram-negative species (e.g. E. coli and K. pneumoniae) can also survive anywhere from weeks to months and can therefore be a continuous source of transmission if no regular preventive surface disinfection is performed.2

Editorial note: A complete list of references is available from the publisher.

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Non-disposable syringe tips resist sterilisation

ST LEONARDS, Australia/DUNEDIN, New Zealand: Owing to their internal construction, air or water syringes commonly used in dentistry are generally prone to bacterial contamination. Using disposable rather than non-disposable syringe tips however could potentially decrease the risk of cross-infection between dental procedures, even when the latter kind have been thoroughly sterilised several consecutive times, researchers from New Zealand have reported in the latest issue of the *Australian Dental Journal*.

Of 68 used non-disposable syringe tips tested for microbiological growth, almost 40 per cent were found to be harbouring different kinds of bacteria after having been sterilised with a Class B autoclave. According to the researchers, the level of contamination did not decrease significantly regardless of the number of additional sterilisation cycles the tips were run through. Flushing the instruments simultaneously with air and water before the cleaning and sterilisation processes also resulted in no difference to the level of contamination, they said.

While control tips of the disposable kind also showed contamination, the level was significantly lower. The researchers suggested that one of the main reasons for the build-up of bacteria or contaminants in non-disposable tips could be corrosion facilitated by continuous exposure of the instruments to humidity during treatment, which increases the roughness of the surface, allowing potentially harmful micro-organisms to accumulate over time. While such micro-organisms might be harmless, they recommend the use of disposable tips over non-disposable tips to reduce the risk of cross-infection.

For the study, new and used non-disposable syringe tips from the urgent care unit at the School of Dentistry of the University of Otago in Dunedin were investigated.

It also found that respondents with a level of infection control practices that exceeded standard precautions, such as wearing a mask or gloves during treatment, were more likely to treat patients with HIV/AIDS. The researchers conducted the survey involving 2,100 dentists in 2011, of which the majority were male, older than 50 years and worked in general practice. The results, while lacking comparability with other developed countries, are a step-up from those reported in an earlier survey in 1996, which found that only one in three would be willing to see patients with the disease.

The researchers conducted the survey involving 2,100 dentists in 2011, of which the majority were male, older than 50 years and worked in general practice. The results, while lacking comparability with other developed countries, are a step-up from those reported in an earlier survey in 1996, which found that only one in three would be willing to see patients with the disease.

The total number of HIV/AIDS cases in Japan exceeded 20,000 in 2012, with the number of new infections per year remaining steady, according to figures from the National Institute of Infectious Diseases in Tokyo. In a report published last year, however, the institution reported that a significant number of new infections appear to go undetected, labelling the national surveillance system as insufficient. The Department of Global Health Policy at the University of Tokyo has predicted HIV/AIDS prevalence to quintuple by 2040, particularly in high-risk groups, unless new measures are introduced to the country’s public health intervention framework.
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caused by bacteria from the same genus as the one which causes Tuberculosis (TB), but was non-
contagious. Within a matter of days I was seen by a Tb special-
ist and commenced treatment the following day. I was told that MAC mimics Mycobacterium
tuberculosis (MtB) and is usually found in thin middle age women with low immunity. He stated that
he wished I had had full-blown infectious Tb as this would have been cleared in six months.
Unlike Tb, it would take a treat-
ment plan of 18–24 months (three
times as long as conventional Tb) to be cleared in six months. Unlike Tb, it would take a treat-
mant plan of 18–24 months (three
times as long as conventional Tb) to be cleared in six months.

These bacteria are found liv-
ing in house dust and tap water. They may infect wild or domestic animals as well as humans. I had never heard of it and was very self-composed when he told me it was a type of lung infection

or simply by breathing the bug in. I was told I had been unlucky and his guess was I had breathed it in and slowly it had reached my lungs and started to attack. The

The cleaning of water lines is something I would not nor-
mally write about but this is going to be a personal article that I would like to raise aware-
ness to. Last year I received a telephone call from a chest consultant who told me that
he thought he knew why I was having recurrent chest infec-
tions, tiredness, and persistent cough. He had taken three spuitum samples from me and
had grown Mycobacterium avium and Mycobacterium intracellulare, otherwise known as a Mycobacterium avium-
intracellulare infection (MAI) or MAC (Mycobacterium avium Complex).

I was ok until I saw that word then I freaked. How can this have happened? How had I caught it? Was I going to die? These were all
questions I was throwing at him. Was I going to die? These were all
questions I was throwing at him.

I was told I had been unlucky and his guess was I had breathed it in and slowly it had reached my lungs and started to attack. The
bug was already in the white blood cells which are responsi-
ble for removing infections in the body. Therefore, it was difficult to get rid of.

MAC is resistant to many an-
thotics; there are limited drugs that can be given but all come with extreme side effects which I
was warned about. One drug can affect the optical nerve in the eye, the
other, your liver. I remember looking at the medication and putting it back in the bag as the mere thought was freaking me out. I have now been on treat-
ment for a year and can’t wait un-
til I can come off. I have since had negative results and my X-ray
is clear but I will have to remain on the drug regime as if there are any stray MAC bugs they will
multiply and I will become very ill again.

The consultant was im-
pressed with how I had tolerated the treatment as many throw

the towel in before completion. Several times that thought had crossed my mind, but I wanted
rid; I wanted to be me again. My reasons for sharing this infor-
mation is to ask you all to be aware that this can come from
sprayed water, so please ensure your water lines are cleaned with one of the many waterline
cleaners/disinfectants manu-
factured. Biofilms form rapidly on dental unit waterlines. The
majority of the organisms in the
biofilm are harmless environ-
mental species, but some dental
units may harbour opportunistic respiratory pathogens.

Effective infection control is one of the cornerstones of good practice and clinical gover-

The importance of clean water lines

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