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 bodily fluids, indirect contact with contaminated objects or surfaces, direct 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 microorganisms and viruses, which can be infectious to susceptible individuals. During treatment, the dentist’s face and the 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 inner corner of the eyes.

Splatter consists of large particles of greater than 100 µm diameter; therefore, they are concentrated towards the dentist’s face. 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 lung, 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. Treatment of exposure to tuberculosis in susceptible DHCP is greater 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 may 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.

### Table 1: Tuberculosis in Asia

<table>
<thead>
<tr>
<th>Country</th>
<th>Estimated # of cases</th>
<th>Estimated rate (per 100,000 population)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pakistan</td>
<td>410,000</td>
<td>254</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>150,000</td>
<td>225</td>
</tr>
<tr>
<td>Indonesia</td>
<td>60,000</td>
<td>185</td>
</tr>
<tr>
<td>India</td>
<td>2,200,000</td>
<td>176</td>
</tr>
<tr>
<td>Myanmar</td>
<td>200,000</td>
<td>577</td>
</tr>
<tr>
<td>Malaysia</td>
<td>24,000</td>
<td>80</td>
</tr>
<tr>
<td>Thailand</td>
<td>10,000</td>
<td>118</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>PPE</th>
<th>Recommendations</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgical mask</td>
<td>• Should cover both nose and mouth</td>
<td>Splatters and aerosols may contain bacteria and viruses that can infect susceptible person in the dental clinic.</td>
</tr>
<tr>
<td></td>
<td>• Change when wet (from sweating, sneezing, breathing or other contamination)</td>
<td>To protect dentists’ and assistants’ oral and nasal mucosa from blood and saliva splatter</td>
</tr>
<tr>
<td></td>
<td>• Use particulate filter respirators (N95) when airborne isolation precautions are necessary (transmission-based precautions for patients with tuberculosis)</td>
<td>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 FFP2 respirators).</td>
</tr>
<tr>
<td>Protective eyewear</td>
<td>• Should be worn all the time</td>
<td>Splatters from dental procedures may come in contact with the conjunctiva and cause irritation or infection.</td>
</tr>
<tr>
<td></td>
<td>• Preferably with lateral protection that is wide enough to cover the eye</td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>• Must be rinsed and disinfected when contaminated between patients</td>
<td>To protect the mucosa of the eyes from splatters.</td>
</tr>
<tr>
<td>Face shield/visor</td>
<td>• Select a face visor with acceptable visual quality (clear, no reflection or refraction) and no fogging</td>
<td>Splashes or splatters generated during dental treatment, especially when using an ultrasonic scaler or high-speed handpiece, are concentrated towards the dentist’s face.</td>
</tr>
<tr>
<td></td>
<td>• Splash or splatters generated during dental treatment, especially when using an ultrasonic scaler or high-speed handpiece, are concentrated towards the dentist’s face.</td>
<td>Wearing a face shield also reduces the amount of splatter contaminating the face area.</td>
</tr>
<tr>
<td></td>
<td>• To protect the face from splatters and aerosols during dental procedures</td>
<td>To prevent the contact of blood and saliva with the dentist’s hands.</td>
</tr>
<tr>
<td>Gloves</td>
<td>• Worn in contact with blood or bodily fluids</td>
<td>To prevent transmission of infection from the patient to the DHCP and vice versa.</td>
</tr>
<tr>
<td></td>
<td>• Double gloving may reduce the risk of exposure to high-risk patients (HIV, hepatitis B or C virus)</td>
<td>Wearing a face shield also reduces the amount of splatter contaminating the face area.</td>
</tr>
<tr>
<td></td>
<td>• Should be worn for the duration of the dental treatment and changed between patients</td>
<td>To protect the contact of blood and saliva with the dentist’s hands.</td>
</tr>
<tr>
<td></td>
<td>• Hands must be washed before wearing gloves</td>
<td>To prevent transmission of infection from the patient to the DHCP and vice versa.</td>
</tr>
<tr>
<td>Protective clothing, such as gowns or jackets</td>
<td>• Change daily or when visibly contaminated with blood or oral fluids</td>
<td>To protect daily clothing from contamination from splatter or aerosols.</td>
</tr>
<tr>
<td></td>
<td>• Wash separately from domestic and non-medical clothing</td>
<td>High occurrence of blood-contaminated splashing in the direction of the dentist during surgical procedures.</td>
</tr>
<tr>
<td></td>
<td>• Preferably long sleeves with a tight cuff</td>
<td>Areas commonly contaminated are the right forearm, abdomen and thorax.</td>
</tr>
</tbody>
</table>

*Page 8*
prevents salivary and blood splatter, and protects the patient’s mouth and airway.

Using personal protective equipment (PPE), such as surgical masks (with at least 95 per cent 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,14 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.15, 16

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.17 Blood cells, as well as bacterial and viral particles, can survive inside handpieces even after disinfection. They must therefore be sterilised between patients.18, 19

The clinic floor should be disinfected and cleaned with an antiseptic disinfectant solution at least twice per day to eradicate any bacterial residue from splatter or aerosols. It is a well-known fact that private dental clinics sometimes employ dental assistants who have not received certified training. Improperly trained personnel, however, may lead to poor infection control practices. It is the responsibility of every dentist to educate and train his or her assistants in the standard procedures. Furthermore, DBHP immunisation status should be up to date.

It remains a difficult task to eliminate the risk of exposure to dental aerosols. The best way to reduce the risks, however, is to employ routine cross-infection protocols recommended by the health authorities, such as the CDC, WHO and ministries of health. To date, various infection control reports and procedures have been published to inform and educate dental health care personnel (DHCP) about the importance of practising adequate infection control.

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

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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 the infection control process 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 unlikely to improve. The WHO’s first global report on antibiotic resistance 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 problematic 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)

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 microorganisms 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 de-contamination 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.

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Non-disposable syringe tips resist sterilisation

between dental procedures, even when the latter kind have been thoroughly sterilised sev- eral consecutive times, re- searchers from New Zealand have reported in the latest issue of the Australian Dental Journal. Of 68 used non-disposable syringe tips tested for microbiolog- ical growth, almost 40 per cent were found to be harbouring dif- ferent kinds of bacteria after hav- ing been sterilised with a Class B autoclave. According to the re- searchers, the level of contami- nation did not decrease signifi- cantly regardless of the number of additional sterilisation cycles the tips were run through. Flush- ing the instruments simultaneous- ly with air and water before the cleaning and sterilisation processes also resulted in no difference to the level of con- tamination, they said.

While control tips of the dis- posable kind also showed con- tamination, the level was signifi- cantly lower. The researchers suggested that one of the main reasons for the build-up of bac- teria or contaminants in non- disposable tips could be corru- sion facilitated by continuous exposure of the instruments to humidity during treatment, which increases the roughness of the surface, allowing poten- tially 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 inves- tigated.

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The importance of clean water lines

Jane Armitage

UK

The cleansing of water lines is something I would not normally write about but this is going to be a personal article that I would like to raise awareness 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 infections, tiredness, and persistent cough. He had taken three sputum 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).

These bacteria are found living 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 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 specialist 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 treatment plan of 18-24 months (three times as long as conventional Tb) and relapses are common even after taking what was described as chemotherapy antibiotics.

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. He explained that this form of non-contagious mycobacterial infection can be caught from the air by breathing the bug in, 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 lung and started to attack. The bug was already in the white blood cells which are responsible for removing infections in the body. Therefore, it was difficult to get rid of.

MAC is resistant to many antibiotics; 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 treatment for a year and can’t wait until 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 impressed 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 information is to ask you all to be aware that this can come from sprayed water, so please ensure your water lines are cleansed with one of the many waterline cleanser/disinfectants manufactured. Biofilms form rapidly on dental unit waterlines. The majority of the organisms in the biofilm are harmless environmental species, but some dental units may harbour opportunistic respiratory pathogens.

Effective infection control is one of the cornerstones of good practice and clinical governance. Due to a combination of negative publicity and an increased scientific knowledge of dental unit waterlines (DUWL) biofilms and their associated risks, contamination of dental unit waterlines has become a prominent infection control issue. Flushing the waterlines for two minutes at the start of the day and for 20-30 seconds between patients reduces the bacterial count but in DUWL where this method is used as the sole means of water quality management flushing is unlikely to provide water of drinking water standard i.e. with a total bacterial count of 100 CFU/ml, nor will flushing remove the biofilm.

However, in dental units, which are not drained down at night, flushing at the start of the day will help to reduce the bacterial load caused by overnight water stagnation. Flushing between patients helps to prevent cross contamination by removing any suck-back of oral fluids that have bypassed the anti-retraction valve. It is recommended to use biocides to control the biofilm by daily draining down and cleaning of the waterlines to reduce biofilm build up. The biocide (disinfectant) can be introduced with a pressurised pump or via an independent reservoir bottle.

I didn’t catch my illness from our water lines but since I have been ill the people around me have looked not only at their water lines but at their cleaning methods at home. Many have

“...some dental units may harbour opportunistic respiratory pathogens.”

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