

# Introduction

The threat of infectious disease transmission has long been a primary concern for all healthcare professions, including dentistry. It comes as a shock, however, to many younger dental professionals that until the middle 1980s, most dentists practiced what we knew as “wet-fingered dentistry” and did not routinely wear gloves, masks, safety eyewear, or other items we now accept as indispensable personal protective equipment (PPE).<sup>1–3</sup> Operative and dental hygiene instruments were often wiped with alcohol sponges or soaked in low-level disinfectants between patients, and in many practices, only surgical instruments were routinely autoclaved.<sup>2</sup>

Following the development of reliable tests to identify hepatitis B virus (HBV) antigens and anti-HBV antibodies in blood, epidemiological studies of dental healthcare professionals (DHCP) revealed alarmingly high rates of HBV exposure and chronic infection (carrier status) when compared to the general population.<sup>4,5</sup> The highest rates were observed among surgeons and dentists—especially oral surgeons. Between 1970 and 1987, several case reports described HBV transmissions from chronically infected dentists and oral surgeons associated with invasive clinical procedures.<sup>6,7</sup> Professional organizations including the American Dental Association (ADA) and the US Centers for Disease Control and Prevention (CDC) responded by developing and publishing policy and procedure guidelines to protect DHCP and patients from the risk of infection.<sup>8</sup> The first ADA dental infection control guidelines were published in 1978,<sup>1</sup> followed by the CDC *Recommended Infection-Control Practices for Dentistry* published in 1986<sup>9</sup> with updates in 1993,<sup>10</sup> 2003,<sup>11</sup> and 2016.<sup>12</sup>

Wet-fingered dentistry, however, was not easily abandoned, nor were recommended infection prevention strategies quickly adopted even as the acquired immunodeficiency syndrome (AIDS) pandemic caused by the human immunodeficiency virus (HIV) surged across the globe.<sup>13</sup> Many practices adopted extraordinary isolation protocols to treat patients known to be infected with HIV, while others simply refused to treat them at all. In 1998, a Supreme Court ruling in a case brought by a patient who had been refused care by her dentist extended protections to all Americans living with HIV, symptomatic or not, as a protected disability under the Americans with Disabilities Act.<sup>14</sup>

In 1987, Congress directed the Department of Labor Occupational Safety and Health Administration (OSHA) to work with the CDC to create rules that would protect healthcare workers, from exposure to HBV, HIV, and other bloodborne pathogens. The OSHA Bloodborne Pathogens Standard (CFR 1910.1030), published in 1991, required employers to protect workers from direct contact with blood or other potentially infectious materials while performing their jobs.<sup>15–18</sup> Foundational in the Standard was the scientifically sound infection control practice of “universal precautions” (UP), which assumes all patients to be infected with a bloodborne pathogen. UP was originally recommended by the CDC for handling of body fluids known to transmit HIV, because patients who are infectious often show no signs or symptoms.<sup>19</sup> UP was later modified by CDC to become Standard Precautions (SP), which, along with required HBV immunization of DHCP and routine childhood vaccination, has proven to be highly effective in decreasing the risk of disease transmission in healthcare settings.<sup>20</sup>

The era of “wet-fingered” dentistry was hastened to its end when the CDC reported in 1991 that a Florida dentist had transmitted HIV to several of his patients—all of whom ultimately succumbed to the disease.<sup>21, 22</sup> As concerns about being infected with HIV in the dental office spread across the country, the profession responded by implementing recommended infection prevention practices and procedures to restore the public’s confidence.<sup>23</sup>

## COVID-19 Pandemic and Federal Guidelines

Preventing exposure to bloodborne pathogens through universal or standard precautions and HBV vaccination of DHCP remained the primary focus and a dramatic success story for dentistry for nearly three decades. Then, in 2020, the world was rocked by the COVID-19 pandemic, caused not by a bloodborne virus, but by SARS-CoV-2, a highly pathogenic respiratory virus easily spread by droplets and aerosols. COVID-19 was being spread not just in clinical settings, but through everyday social contact.<sup>24, 25</sup> Early in the pandemic, many dental practices were shut down or limited to providing emergency care by local authorities to help slow community transmission and, in some cases, to conserve scarce PPE.

The profession appears to have successfully navigated many of the challenges of COVID-19, just as it did with HIV and HBV in 1991 and 1992.<sup>26, 27</sup> CDC, OSHA, and professional organizations including the ADA responded with new infection prevention measures to make dentistry safe for patients and DHCP and help reduce community transmission. The pandemic should serve as a reminder that there remains the daily risk of exposure not just to bloodborne pathogens and airborne pathogens like SARS-CoV-2, but to herpes simplex virus types 1 and 2,<sup>28</sup> cytomegalovirus (CMV),<sup>29</sup> influenza,<sup>30, 31</sup> measles,<sup>32–34</sup> and other viruses and bacteria that colonize or infect the upper respiratory tract,<sup>35</sup> conjunctiva, and skin, as well as environmental organisms such as *Legionella*<sup>36</sup> and nontuberculous *Mycobacteria* (NTM),<sup>37, 38</sup> which may be present in water used for dental treatment.<sup>39–43</sup>

In 2016, the CDC published the *CDC Summary of Infection Prevention Practices in Dental Settings: Basic Expectations for Safe Care*, based on the 2003 *CDC Guidelines for Infection Control in Dental Health-Care Settings*, which remains the recognized national standard of care. This currently effective publication summarizes the key elements of the 2003 guideline in a more user-friendly format and provides new tools and checklists to help the dental team with successful implementation.<sup>12</sup>

# How to Use This Book

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## Who Should Use It

This book is designed for use by all dental healthcare personnel, including dentists, hygienists, assistants, dental laboratory technicians, and administrative staff. This guide can form the basis of a comprehensive infection prevention and control program for the dental office or other treatment setting.

## How to Begin

Although this guide and its recommendations may be implemented in many ways, it may be most effective and contribute to building a culture of safety if members of the dental team proceed through each chapter together. It may be especially helpful if the learning experience is led by an experienced infection prevention and control (IPC) coordinator who is knowledgeable about the policies and procedures specific to the dental treatment facility.

This approach has several advantages:

- It can help to ensure that all members of the team have completed the material and understand their roles and responsibilities.
- The IPC coordinator can use this guide in team meetings to answer questions and ensure that all employees understand concepts, policies, and procedures.
- It contributes to setting team goals for implementation that engage all members of the dental team.

## To Use This Guide

1. Appoint a dental team member to serve as IPC coordinator with the responsibility for ensuring that all team members complete the training.
2. Begin by completing the Self-assessment Checklist as a way of reviewing current infection prevention and control practices and knowledge. Each member of the dental team involved in patient care should complete the self-assessment. By comparing team members' results, you will be able to determine the consistency of infection prevention and control efforts and identify differences in perception, opinions, or practices among individuals.

A digital copy of the checklist is included with the e-book that accompanies this guide, so you may print and reprint the assessment as needed. To access your e-book, view the instructions on the inside front cover of this guide.

3. After completing the self-assessment, proceed through the chapters in order.
4. Complete the review questions (starting on page 114) for each chapter before proceeding to the next one. Again, keep the form included with the program as an original. Print or make photocopies as needed. A staff meeting is useful for answering questions and clarifying the material.
5. The Goal-setting Worksheets are provided to assist in the development of an office infection prevention and control program. These can also be completed at the staff meeting. The staff meeting provides an excellent opportunity to begin developing office policies for infection control. Follow-through with goals and action plans for establishing an infection prevention and control program will be improved if the entire staff is involved in the process.

# Infection Prevention and Control Self-Assessment Checklist

Read each of the following items listed and specify if they are performed (yes or no) by checking the box provided.

## Which of the following dental treatment facility policies and programs have been implemented?

- An Infection Prevention and Control (IPC) Coordinator has been appointed and has received necessary training to perform these duties. ☐ Yes ☐ No
- Written IPC and Occupational Safety and Health (OSH) policies and standard operating procedures (SOPs) have been prepared and DHCP have acknowledged that they have read and understand them. ☐ Yes ☐ No
- IPC, OSH, and pandemic/emergency preparedness plans, policies, and SOPs are reviewed at least annually and are updated in response to changes to applicable law, regulation, or organizational policies. ☐ Yes ☐ No
- All DHCP receive IPC, OSH, and pandemic/emergency preparedness education and training at least annually and as necessary to respond to changes in policy or procedures. ☐ Yes ☐ No

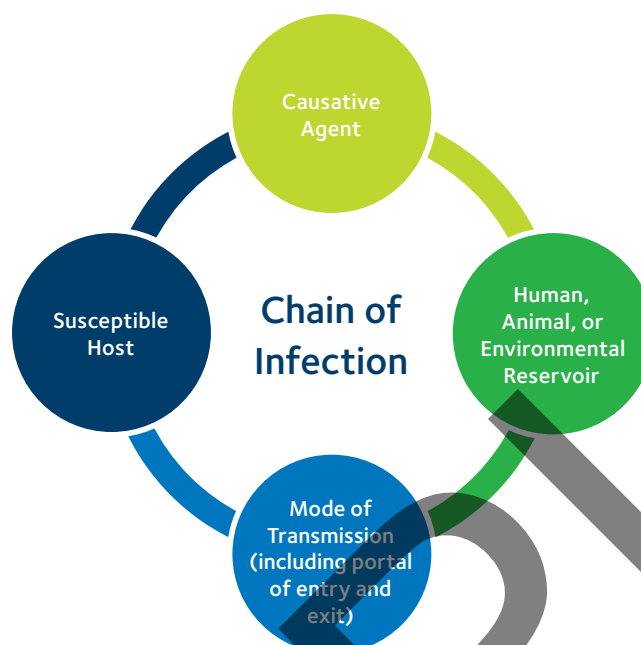
Read each of the following items listed and specify how often you do each (always, sometimes, never) by checking the box provided.

## Before seating the patient and beginning clinical treatment, how often do you?

- Use the same infection prevention and control procedures for all patients based on the risk posed by the procedure, not solely on perceived risk based on the patient's medical history or other personal characteristics?  
☐ Always ☐ Sometimes ☐ Never
- Protect dental records, charts, radiographs, and digital devices (e.g., smartphone, laptop, tablet) from becoming contaminated during patient treatment?  
☐ Always ☐ Sometimes ☐ Never
- Keep the operatory free of unnecessary items that may become contaminated during clinical procedures?  
☐ Always ☐ Sometimes ☐ Never

(Continued on next page)

Figure 1.1. Chain of Infection



Each link in the chain is necessary for an infection to spread. Effective infection prevention and control and prevention strategies are intended to break one or more links to avoid disease transmission. Let's now look at each link and learn how we can thwart the spread of infectious disease.

### Causative Agent (Pathogen)

Causative agents include pathogenic bacteria, fungi, **protozoa**, and parasitic worms that infect a susceptible host and cause disease.<sup>64, 65</sup> Each of these microscopic organisms uses their own DNA and cellular machinery to grow and reproduce, either in a living host or in the environment. **Viruses**, however, can only reproduce by hijacking the cellular machinery of bacterial, plant, or animal cells to make copies of themselves (virions), which can cause disease and then can be transmitted to a new host.<sup>65</sup> Prions are another type of causative agent that consists of infectious, non-living proteins which, on contact with normal proteins in brain tissue, slowly but irreversibly change their shape and alter brain function, ultimately resulting in death. Examples of prion-spread diseases include Creutzfeldt-Jakob disease and so-called "mad-cow" disease, which are known as spongiform encephalopathies.<sup>66, 67</sup>

**To break this link:** Be educated about the nature and prevalence of pathogens likely to be present in your clinical environment and community. Develop policies and procedures using recommended infection prevention strategies spelled out in this guide to prevent disease transmission between DHCP and patients, from one patient to another, and among DHCP and nonclinical staff, their families, and the community.

### Human, Animal, or Environmental Reservoirs

Pathogens require a source reservoir in which to survive prior to transmission to a host. These may be living organisms such as humans or animals or environmental reservoirs like water or soil. Examples of infectious agents from the human reservoir include **bloodborne pathogens** such as HBV,<sup>68, 69</sup> HCV,<sup>68, 69</sup> and HIV.<sup>70</sup> Bacterial respiratory pathogens such as *Mycobacterium tuberculosis* (TB)<sup>61</sup> and *Bordetella pertussis* (the bacteria that causes "whooping cough")<sup>73</sup> may be present in saliva, nasal secretions, and respiratory droplets encountered in dental procedures. The viruses that cause other respiratory diseases like measles,<sup>34</sup> varicella (chickenpox),<sup>71</sup> influenza,<sup>58, 72</sup> or COVID-19<sup>25</sup> may also be present in the oral cavity and in nasal secretions and may be spread via an airborne route. Pathogens such as MRSA,<sup>74</sup> HSV,<sup>28</sup>

## Preventing Transmission of Respiratory Pathogens

Methods used to reduce the risk of respiratory pathogens in the dental setting include the use of transmission-based precautions, contact precautions, and droplet and airborne precautions.

### Transmission-based Precautions

**Transmission-based precautions**, as applied in medical in-patient settings, are used in addition to standard precautions to prevent exposure to pathogens that may be spread by direct contact with infected skin or mucous membranes or by droplets and airborne particles.<sup>135</sup>

**Contact precautions** are used to prevent spread of multi-drug resistant organisms (e.g., MRSA and vancomycin-resistant enterococci (VRE)) or highly infectious disease like Ebola Fever among hospitalized patients and healthcare professionals by contaminated hands and patient care equipment.<sup>103</sup> In outpatient dental settings, conscientious adherence to source control measures and standard precautions should be sufficient to avoid disease transmission by the contact route and are not covered in more detail in this section.

**Droplet and airborne precautions** in dental settings are used to avoid transmission of epidemiologically important disease spread by exposure of the oral and nasal mucosa and pulmonary system (e.g., COVID-19, pandemic influenza, measles, and tuberculosis). These precautions rely on following respiratory hygiene and cough etiquette, source control measures, work practice controls, and engineering controls to reduce the number of potentially infectious droplets and aerosols in the clinical environment.

The potential for infection from airborne or droplet exposure is due to the physical characteristics of particles and their ability to stick to susceptible tissues in numbers sufficient to initiate infection; the survivability, infectivity, and virulence of the pathogen; and the immunological status of the person exposed. A defining characteristic is particle size. Spatter and droplets do not remain suspended in air for extended periods of time. Particles less than 5  $\mu\text{m}$ , however, can stay airborne indefinitely, unless removed by air currents or ventilation, and can be inhaled into the lower respiratory tract. Most respiratory infections, including colds and influenza, are transmitted by respiratory droplets larger than 5–10  $\mu\text{m}$  in size. *Mycobacterium tuberculosis* is an example of an organism transmitted by infectious droplet nuclei containing viable bacterial cells that are 5  $\mu\text{m}$  or smaller.<sup>104, 137–141</sup>

In medical settings, the term “airborne precautions” has been supplemented with the term airborne infection isolation (AII) room for consistency with the CDC *Guidelines for Environmental Infection Control in Health-Care Facilities*,<sup>104</sup> and the CDC *Guidelines for Preventing the Transmission of Mycobacterium Tuberculosis in Health-Care Settings*, 2005.<sup>142</sup>

Practicing according to medical isolation guidelines is not possible in most outpatient dental facilities. Therefore, except when no other option is available, potentially infectious patients with urgent or emergent dental needs should be referred to a facility capable of providing AII.<sup>104, 135</sup> Infectious patients in need of routine care, or with conditions that can be managed with palliative care, can have treatment deferred until they are no longer infectious.

Transmission-based precautions based on these guidelines should be implemented routinely for potentially infectious patients for all procedures,<sup>143</sup> and for all aerosol-generating procedures (AGP) when there is moderate to substantial community transmission of highly infectious diseases or during declared public health emergencies.



A discussion follows concerning the factors you should consider when making decisions about when to use each process. Next, we review the advantages and disadvantages of the various cleaning, decontamination, disinfection, and sterilization methods and describe what you need to do to ensure that terminal sterilization is effective. The next section discusses liquid chemical disinfecting agents, and concludes with a discussion of infection prevention and control practices for use in the dental laboratory.

## Cleaning, Decontamination, Disinfection, and Sterilization

**Cleaning** is the removal, usually with detergent and water or enzyme cleaner and water, of visible soil, blood, protein substances, microorganisms, and other debris from the surfaces, crevices, serrations, joints, and lumens of instruments, devices, and equipment by a manual or mechanical process that prepares the items for safe handling and/or further decontamination.<sup>214</sup>

**Decontamination** is described by OSHA as “the use of physical or chemical means to remove, inactivate, or destroy bloodborne pathogens on a surface or item to the point where they are no longer capable of transmitting infectious particles and the surface or item is rendered safe for handling, use, or disposal” [29 CFR 1910.1030]. In healthcare facilities, the term generally refers to all pathogenic organisms.<sup>15, 16, 214</sup>

**Disinfection** is a process that can inactivate most microorganisms but is less lethal than heat or **chemical sterilization** processes. Microorganisms vary in their resistance to germicidal chemical agents with bacterial spores having the greatest resistance to both chemical disinfectants and heat-based processes.<sup>214</sup> Vegetative (non-spore formed) bacteria and lipid enveloped viruses (including hepatitis B virus [HBV], hepatitis C virus [HCV], and human immunodeficiency virus [HIV], and SARS-CoV-2) are the most susceptible to chemical disinfectants.<sup>215</sup> Because mycobacteria have a waxy cell wall that limits penetration of germicides, *Mycobacterium bovis*, also called Bacillus Calmette and Guérin (BCG), is used by testing laboratories as a reference organism for product label claims of effectiveness against more susceptible organisms, including vegetative bacteria and some viruses.<sup>216</sup> When selecting products, be wary of product claims regarding rapid tuberculocidal activity since high alcohol content may enhance tuberculocidal activity but have little or no beneficial effect on activity against other organisms. Keep in mind as well that tuberculosis (TB) is spread by respiratory transmission and is not a risk for transmission from surfaces.

Non-lipid enveloped viruses exhibit highly variable patterns of resistance to disinfectants, and the US Environmental Protection Agency (EPA) requires that manufacturers test products for activity against specific viruses to make a label claim for effectiveness. During the COVID-19 pandemic, the EPA made an emergency exemption for this requirement and posted an online document called the “N-List” for products with presumed activity against SARS-CoV-2 based on activity against similar infectious agents.<sup>217</sup>

In the US, the EPA and US Food and Drug Administration (FDA) regulate hospital disinfectants and classify them based on their ability to inactivate different types of organisms, as described earlier. When selecting agents for the appropriate use in dental settings, always read the product label to ensure the correct product is used for the correct application at the correct contact time. Use only EPA registered hospital disinfectants in clinical settings.

Products may come in several formulations, including as liquids, sprays, and towelettes, and may be formulated to clean as well as disinfect surfaces. Follow instructions for proper dilution, labeling of secondary containers, the need for pre-cleaning with a detergent before application, and for disposal of unused product. Refer to safety data sheets for information on possible health hazards associated with occupational exposure.<sup>162</sup>

The effectiveness of any disinfection procedure is influenced by several factors, including the type and number of microorganisms present, the concentration and length of exposure to the disinfecting agent, and the amount of organic matter or other debris present on the item being disinfected. For disinfecting

- Use sterile barriers for surfaces that will be contacted by hands or instruments during oral surgery. Autoclavable removable light handles or sheets of sterilized aluminum foil are two frequently used options. For surface barriers, the sterile internal sides of sterilization wraps may be used to place instruments and supplies during procedures.<sup>11</sup>
- Set up paper records and/or conventional film radiographs and/or digital images before seating the patient, and avoid contamination from spatter or droplets or contaminated gloves. Record entries should only be made before gloves are put on or after they have been removed and hands have been washed.<sup>11</sup>
- Barrier protect digital data entry devices (e.g., keyboard, mouse, laptop, tablet, and smart phone) if used during patient treatment. Consider use of voice-activated devices to avoid contact with data entry systems. If digital items are not barrier protected, keep them away from areas where they may be contaminated with spatter or droplets or touched with contaminated gloves.<sup>11, 223</sup>

**In addition to reducing the risk for transmission of infectious agents during patient care, planning will make the treatment session more efficient, and will also make the post-treatment infection prevention and control process easier and more effective.**

## Personal Protective Equipment

In preparation for patient care, DHCP should don appropriate personal protective equipment (PPE) for the procedure and infectious disease transmission risk posed by the patient. Under Standard Precautions, all patients are assumed to be infectious for bloodborne pathogens (e.g., hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV)), and PPE should be appropriate to prevent exposure to mucous membranes, eyes, and non-intact skin.<sup>11, 12, 15, 16</sup> For diseases potentially transmitted by droplets and aerosols (e.g., COVID-19, influenza, and measles), additional PPE may be necessary to avoid respiratory exposure.<sup>143, 190</sup>

## PPE Wear under Standard Precautions

The PPE guidance in this section under Standard Precautions assumes that there is low risk for respiratory disease transmission. During declared public health emergencies or high community rates of respiratory infection, fit-tested NIOSH N95 or equivalent filtering faceplate respirators (FFR) may be recommended by public health agencies for patient contact. (See Airborne Transmission Precautions in chapter 1 for more detailed discussion of this topic.)

- Gowns protect skin and clothes from spatter of saliva and blood. A high-necked, long-sleeved gown offers the best protection. Select clothing that is comfortable to wear.<sup>11, 12, 16</sup>
- Protective eyewear with side shields, face shields, or goggles must be worn during procedures that involve splash and spatter of saliva and blood, or that have the potential for creating projectiles.<sup>11, 12, 16</sup>
- A surgical mask will protect the mucous membranes of the nose and mouth from splash, spatter, or droplets of blood, saliva, or other potentially infectious material (OPIM) but offer limited protection from aerosols generated by coughing, sneezing, loud talking, or dental aerosol-generating procedures (AGP). Masks must fit as snugly as possible around the face. Use a new mask for each patient, and change it if it becomes wet or damp to avoid loss of filtration effectiveness.<sup>11, 12, 16</sup>
- When procedures are completed and mask wear is no longer indicated, remove masks completely and discard as nonregulated waste. Never wear masks around the neck, dangling by an ear loop, or around a wrist.<sup>11, 12, 16</sup>