

# The Infection Control Forum

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## Abstract

Because of the emergence of resistant organisms such as MRSA and the many different routes of disease transmission in the dental office, adherence to the Standard Precautions is increasingly important for dental healthcare workers. The use of barriers and surface disinfectants are effective means of preventing disease transmission when properly employed. Additionally, one-step and tuberculocidal products containing a biodegradable detergent can decrease cost and increase efficiency for dental HCW's.

## Learning Objectives

After reading this article the reader should be familiar with:

- Why it is important to properly disinfect environmental surfaces.
- Which surfaces need to be disinfected, and how and when barriers should be used.
- The difference between intermediate-level and low-level disinfectants.
- The difference between a one-step and two-step product.

## Editor

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## Surface Disinfection in the Dental Office:

Why, How and What - Part 1

By Louis G. DePaola, DDS, MS

During the delivery of dental care there is the potential for dissemination of numerous microorganisms that colonize the mouth and/or oral, nasal and respiratory fluids and secretions.<sup>1</sup> Dentists, dental staff and patients may be exposed to a variety of pathogenic microorganisms from these sources within the dental office including herpes, bloodborne pathogens, multiple species of *Staphylococci* and *Streptococci* and numerous other viruses and bacteria.<sup>1</sup> Contamination from any of these organisms may result in disease transmission which may

occur directly from contact with infected body fluids and tissues or indirectly from contact with surfaces and/or devices that have been contaminated. The cornerstone for prevention of disease transmission in the dental office is the Standard Precautions. An essential component of Standard Precautions is proper cleaning, management and disinfection of all environmental surfaces. This issue of the *Forum* and the next will review the principles of surface disinfection and address the following questions: Why is careful management of environmental surfaces necessary? How should environmental surfaces be managed? And, what properties should the clinician look for in a surface disinfectant?

## Standard Precautions Update

The potential routes of transmission of disease in the dental office are well documented.<sup>1</sup> During the delivery of dental care there may be direct contact with blood, oral fluids (including saliva), other bodily fluids, or other patient materials as well as indirect contact with contaminated objects including instruments, devices, equipment, or environmental surfaces.<sup>1</sup> Furthermore, there is the risk of eye, nose, mouth, and mucous membrane contact with heavily contaminated droplets from splatter, and the potential for inhalation of airborne microorganisms that can remain suspended in the air for long periods of time.<sup>1</sup>

It is important to eliminate or to reduce each route of disease transmission as

much as possible. This is best accomplished by incorporating recommended Centers for Disease Control and Prevention (CDC) and Occupational Safety and Health Administration (OSHA) infection control guidelines and standards into the routine practice of dentistry.<sup>1,2</sup> Standard Precautions must be used every day for every patient contact regardless of the presence or absence of infectious disease.<sup>1</sup> Because of the ever-changing emergence of new pathogens and the development of antimicrobial resistance, Standard Precautions were updated in 2007 to include three new elements: respiratory hygiene and cough etiquette, safe injection practices, and use of masks for insertion of catheters or spinal/epidural injections.<sup>3,4</sup> The most recent and significant principles of standard precautions can be found at [www.cdc.gov/ncidod/dhqp/pdf/isolation2007.pdf](http://www.cdc.gov/ncidod/dhqp/pdf/isolation2007.pdf).

The barriers recommended in Standard Precautions (gloves, masks, eye protection, etc.), when properly used, effectively reduce the risk of infection from direct contact with blood, body fluids and splatter. However, indirect contact from a variety of sources results in the contamination of numerous environmental surfaces and patient care items.<sup>1</sup> Instruments, devices, equipment and surfaces indirectly contaminated with blood and/or body fluids also poses a risk for disease transmission. Therefore proper infection control practices must be instituted to manage and disinfect environmental surfaces.<sup>1</sup>

## Why Is Surface Disinfection Necessary?

Many environmental surfaces, parts of dental equipment and devices, and components of the dental unit are routinely contaminated by direct or indirect contact with fluids.<sup>1</sup> If proper infection control practices are not followed, any of these contaminated items and surfaces can become a potential source of infection to the dental staff and subsequent patients.<sup>1</sup> Additionally, dissemination of these organism(s) to uninfected instruments, devices, equipment and other environmental surfaces may occur, increasing the level of contamination and the risk of disease transmission. The principles of infection control dictate the reduction of any source of contamination including environmental surfaces. The most recent CDC Guidelines published in 2003 should serve as the standard for clinicians regarding the management and disinfection of environmental surfaces. This document can be downloaded in its entirety at <http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5217a1.htm>.<sup>1</sup>

The overwhelming majority of dental practitioners accepts and practices Standard Precautions; as a result, the rate of disease transmission in the dental office in the past 25 years has been very low.<sup>1</sup> However, the recent case of patient-to-patient transmission of hepatitis B virus associated with oral surgery, possibly linked to a contaminated surface, (reviewed in Forum, Volume V, Issue III) and the emergence and propagation of antimicrobial resistance (Volume V, Issue IV) are two significant phenomena that indicate the importance of adherence to Standard Precautions, especially hand hygiene and disinfection of environmental surfaces.<sup>5-7</sup>

Of the resistant microorganisms, methicillin-resistant *Staphylococcus aureus* (MRSA) has been frequently associated with hospitals and medical facilities and has been shown to be spread HCW-to-patient, patient-to-HCW, patient-to-patient, and HCW/patient-to-device/surface.<sup>8,9</sup> Non-compliance with recommended infection control practices has significantly contributed to the spread of MRSA and other resistant organisms.<sup>8,9</sup> These emerging microbial threats necessitate hand hygiene and proper disinfection of environmental surfaces with an EPA-registered disinfectant to minimize the impact of diseases such as MRSA.<sup>8,9</sup> Every HCW must practice Standard Precautions, including management and disinfection of environmental surfaces, with every patient contact.

Figure 1. Clinical Contact Surfaces



Table 1. Clinical Contact Surfaces<sup>1</sup>

Any surface that is touched by contaminated hands, aerosol, instruments, devices, or other items while providing dental care is defined as a Clinical Contact Surface. Examples of such surfaces include:

- Light handles,
- Switches,
- Dental radiology equipment (including digital sensors)
- Dental chairside computers, mouse and keyboards,
- Reusable containers of dental materials,
- Drawer handles, doorknobs.
- Faucet handles,
- Countertops, mobile carts/cabinets
- Pens, pencils
- Telephones, intercom

Table 2. General Recommendations for Environmental Surfaces.<sup>1</sup>  
Clinical Contact Surfaces

- Use surface barriers to protect clinical contact surfaces, particularly those that are difficult to clean or may be damaged by liquid agents
  - Switches on dental chairs/units, etc.
- Change surface barriers between patients
- At the end of the day clean and disinfect clinical contact surfaces by using an EPA-registered hospital disinfectant with a:
  - Low-level product with HIV and HBV label claims or an intermediate-level product with tuberculocidal activity
  - Use an intermediate-level disinfectant if visibly contaminated with blood.

#### OR

- Clean and disinfect clinical contact surfaces that are not barrier-protected by using an EPA-registered hospital disinfectant with a:
  - Low-level product with HIV and HBV label claims or an intermediate-level product with tuberculocidal activity at the end of the day
  - Use an intermediate-level disinfectant if visibly contaminated with blood.
    - Follow the manufacturer's instructions for correct use
    - Do not use liquid chemical sterilants/high-level disinfectants for disinfection of clinical contact or housekeeping surfaces.
    - Use personal protective equipment when cleaning and disinfecting environmental surfaces (gloves, mask, eye protection, clinical gown)

#### Housekeeping Surfaces

- Clean housekeeping surfaces (e.g., floors, walls, and sinks) with a detergent and water or an EPA-registered hospital disinfectant/detergent on a routine basis,
  - Clean mops and cloths after use and allow drying before reuse; or use single-use, disposable mop heads or cloths.
  - Prepare fresh cleaning or EPA-registered disinfecting solutions daily and as instructed by the manufacturer.
  - Clean walls, blinds, and window curtains in patient-care areas when they are visibly dusty or soiled.

## Managing Environmental Surfaces: Clinical Contact vs. Housekeeping

The CDC has divided environmental surfaces in the dental office into two categories based on the degree and type of contamination to which the surface is exposed.<sup>1</sup> Any surface touched by contaminated hands, aerosol, instruments, devices, or other items in the course of providing dental care that has been either directly or indirectly contaminated are referred to as clinical contact surfaces (Figure 1).<sup>1</sup> Table 1 lists the most common clinical contact surfaces in the dental office. All other surfaces, such as floors, walls, etc. are defined as housekeeping surfaces.<sup>1</sup> General recommendations for the management of environmental surfaces are listed in Table 3.<sup>1</sup>

## Barrier Use vs. Disinfection of Environmental Surfaces

An environmental surface can either be covered with an impervious barrier or disinfected with an EPA-registered surface disinfectant. Either method is acceptable and use of barrier protection or chemical disinfection is largely a matter of practicality and personal choice.

Barrier protection is the most efficient way to protect smaller or more difficult-to-clean surfaces. The barrier must be impervious to fluids. Materials such as plastic wrap, bags, sheets, tubing, and plastic-backed paper are acceptable. When properly placed, barriers are very effective in preventing both direct and indirect contamination.<sup>1</sup> These are single-use items and must be discarded after every patient contact and replaced with a new barrier. No disinfection is necessary if the barrier has remained intact throughout the entire procedure; however, if a barrier has been breached (ripped, torn, fallen off) or the covered surface has evidence of contamination upon barrier removal, the surface needs to be cleaned and disinfected. At the end of each day every clinical contact surface, regardless of barrier use, should be cleaned and disinfected with an EPA-registered disinfectant.<sup>1</sup>

Conversely, many surfaces are too large to be covered. If this is the case these clinical contact surfaces should be cleaned to remove all bioburden and disinfected with an EPA-registered hospital disinfectant after every patient contact. In 2003, the CDC broadened the list of agents acceptable for surface disinfection to include the use of a low-level disinfectant with an HIV/HBV claim on surfaces not visibly contaminated with blood (See Table 3).<sup>1</sup> However, an intermediate-level disinfectant (tuberculocidal claim) may be used on any clinical contact regardless of the presence or absence of blood.

It is important to note that use of an intermediate-level disinfectant is specifically indicated when the surface is visibly contaminated with blood.<sup>1</sup> There is little if any cost difference between low and intermediate-level agents and clinicians should consider purchasing more versatile intermediate-level disinfectants (Table 3).<sup>1</sup> Another significant change in the 2003 Guidelines is that only EPA-registered

agents should be used to disinfect clinical contact surfaces; therefore as household bleach is not EPA-registered for this purpose, diluted bleach should not be used.<sup>1</sup> Furthermore, liquid chemical sterilants and high-level disinfectants (such as glutaraldehyde and related chemicals) should not be used for disinfecting environmental surfaces.<sup>1</sup>

## Clean That Surface

Disinfection is inhibited or incomplete in the presence of bioburden and all the clinical contact surface(s) must be thoroughly cleaned before disinfection can occur. Therefore, the first fundamental step in the disinfection process is cleaning. Each clinical contact surface should be pre-cleaned; cleaned with an absorbent material containing a cleaning agent, usually a detergent, before application of the disinfectant (Table 3).<sup>1</sup> If thorough cleaning is not possible or practical, that surface should be covered with an impervious barrier.<sup>1</sup> There are many formulations of disinfectants and products that contain a detergent and disinfectant in one formulation. This reduces the number of items in the office inventory, is more convenient, and usually decreases cost.

Although alcohol kills microorganisms, it is a very poor cleaner. In general, the higher the percentage of alcohol in a product, the less effective the cleaning. Due to their poor cleaning properties, solutions containing a high concentration of alcohol should be used only after the surface has been precleaned (a two-step process).

## One-Step vs. Two-Step Products

Formulations and properties of disinfectants vary greatly. Chemical germicides are divided into two types: one-step and two-step (See Table 3).<sup>10</sup> One-step disinfectants contain a detergent that allows for cleaning (the removal of bioburden) and disinfection of hard surfaces with a single application.<sup>10</sup> One-step products are effective in most clinical applications and pre-cleaning of the contaminated surface is only required when the surface is heavily contaminated.

**Table 3. Cleaning and Disinfecting Clinical Contact Surfaces: One-step vs Two-step and Tuberculocidal Disinfectant Products (Courtesy of INEEDCE.com PennWell® Corporation)**

Process	One Step Disinfectant	Two Step Disinfectant	Tuberculocidal Disinfectant (Intermediate Level)	Non-Tuberculocidal Disinfectant (Low Level)
Spray (Apply)		Apply detergent to clinical contact surfaces		
Wipe (Clean)		Physically clean clinical contact surfaces		
Spray (Apply)	Apply detergent to clinical contact surfaces, physically clean clinical contact surfaces and apply EPA-registered liquid chemical disinfectant	Apply EPA-registered liquid chemical disinfectant		
Wait (Disinfect)	Disinfect clinical contact surface. Contact time for a specific agent ensures antimicrobial activity.	Disinfect clinical contact surfaces. Contact time for a specific agent ensures antimicrobial activity.		
Advantages	Cleans and disinfects in one step. Only one product needed for surface disinfection.	Effective only when used on pre-cleaned surfaces.	Intermediate-level product with tuberculocidal activity may be used on surfaces visibly contaminated with blood.	
Also may be used on surfaces not visibly contaminated with blood.				
Disadvantages		Must clean surface; then apply disinfectant. May require two products depending on formulation of disinfectant.		Low-level product with HIV and HBV label claims should be used on surfaces NOT visibly contaminated with blood. Need additional product for surfaces visibly contaminated with blood.

Other formulations require pre-cleaning followed by disinfection under all conditions and are known as two-step germicides.<sup>10</sup> The two-step process, commonly referred to as spray-wipe-spray, is recommended whenever these products are used. As suggested by the name, the surface must first be cleaned with a detergent.<sup>1,10</sup> This application must be followed by a wipe that physically removes bioburden or other debris that might interfere with disinfection (pre-cleaning).<sup>1,10</sup> Once the surface is thoroughly cleaned, it can be disinfected.<sup>1,10</sup> A second spray with an EPA-registered liquid chemical germicide, is applied to the surface in the second phase of the two-step process.<sup>1,10</sup>

With either the one or the two-step process, the chemical must remain in contact with the surface for the contact time stated on the disinfectant's label.<sup>1</sup> The one-step and two-step disinfectant processes are outlined in Table 4. The most significant advantage of the one-step product is that one application of disinfectant vs. two saves considerable time and uses less product. However, any heavily contaminated surfaces should be cleaned and disinfected using the two-step process.<sup>1,10</sup>

### Effects On Equipment

The adverse effect that a disinfectant has on dental equipment such as chair upholstery, vinyl surfaces, etc is an important consideration when choosing a product. A recent study evaluated the effect of long-term disinfection of five spray-type disinfectants (diluted bleach, Lysol Brand II IC, Birex, Cavicide, Discide Ultra, and tap water as a control) on the ability to clean common dental surfaces made of smooth vinyl, textured vinyl, brushed aluminum, high impact plastic, and smooth stainless steel.<sup>11</sup> The data documented that Birex produced the fewest statistical differences of the disinfectants tested while diluted bleach had the most adverse effects.<sup>11</sup> Of the five disinfectants tested in this study, Birex had the least deleterious effect on test surfaces and the best cleaning activity compared to the control.<sup>11</sup> Clinicians should check the compatibility of any chemical agents before application to the various surfaces in the dental office.

### How to Choose A Surface Disinfectant

A disinfectant should be efficacious, safe, cost-effective, and easy to use. How does the clinician determine which chemical germicide is the best for his/her needs? This is a complex question and requires being aware of how disinfectants are regulated and tested.<sup>1</sup> In the USA, two agencies regulate disinfectants: the Environmental Protection Agency (EPA), which is responsible for all liquid chemical disinfectants used on noncritical surfaces, and the Food and Drug Administration (FDA), which regulates any high-level disinfectants and sterilants.<sup>1,10</sup>

The EPA classifies disinfectants differently than either the CDC or the FDA, which designate any EPA-registered hospital disinfectant without a tuberculocidal claim as a low-level disinfectant and any EPA-registered hospital disinfectant with a tuberculocidal claim as an intermediate-level disinfectant (Table 3).<sup>1,10,12-16</sup> In contrast, the EPA does not consider tuberculocidal activity (intermediate-level or low-level disinfectants as classified by CDC/FDA) and registers environmental surface disinfectants based on the manufacturer's microbiological activity claims when registering its disinfectant.<sup>1,10,12-16</sup> Manufacturers may decide to test specifically against organisms of known concern in healthcare practices such as HIV, HBV, hepatitis C virus (HCV), and herpes, which could then be put into label claims.<sup>12-16</sup>

A listing of disinfectants registered with the EPA, according to their efficacy against certain bloodborne/body fluid pathogens, can be found at <http://www.epa.gov/oppad001/chemregindex.htm>. A more user-friendly, updated surface disinfectant reference chart can be found at the Organization for Safety and Asepsis Procedures (OSAP) website, [www.osap.org](http://www.osap.org).<sup>17</sup>

### Conclusions

- Disinfection of clinical contact surfaces is an essential component of Standard Precautions and should be performed according to the Guidelines for Infection Control in Dental Health-Care Settings, 2003.<sup>1</sup>
- Clinical contact surfaces should be managed according to CDC recommendations and should either be covered with an impervious barrier or disinfected with an EPA-registered liquid chemical germicide between each patient.
- Products with the "one-step" claim may lessen the number of products in the office inventory and the time required for surface disinfection.
- Products that are tuberculocidal and contain a biodegradable detergent may decrease cost and increase efficiency.

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# CE Questions

## Surface Disinfection in the Dental Office:

### Why, How and What - Part 1

Test Instructions- Please fill in the bubble corresponding to the answer you believe to be correct for each question. Mail or fax completed tests to the Richmond Institute to receive CE Credit.

- Standard Precautions were updated in 2007 to include which of the following new elements?
  - Respiratory hygiene/cough etiquette
  - Use of masks for insertion of catheters or spinal/epidural injections
  - Safe injection practices
  - All the above
  - None of the above
- Any surface that is touched by contaminated hands, aerosol, instruments, devices, or other items while providing dental care is defined as a:
  - Clinical contact surface
  - Housekeeping surface
  - One-step product
  - Two-step product
  - None of the above
- Which of the following is indicated to disinfect a surface contaminated with blood?
  - Low-level disinfectant with HIV/HBV claim
  - Intermediate-level disinfectant
  - High-level disinfectant
  - All the above
  - None of the above
- Which of the following is indicated to disinfect a surface not contaminated with blood?
  - Low-level disinfectant with HIV/HBV claim
  - Intermediate-level disinfectant
  - High-level disinfectant
  - All the above
  - None of the above
- Which of the following is not a clinical contact surface?
  - Light handles
  - Dental chairside computer, mouse and keyboard
  - Operatory floors
  - Dental radiology equipment
  - Reusable containers of dental materials
- It is acceptable for a clinical contact surface to be:
  - Covered with an impervious barrier
  - Disinfected with an EPA-registered surface disinfectant
  - A & B
  - None of the above
- The two-step disinfectant contains a detergent that allows for cleaning, the removal of bioburden and disinfection of hard surfaces with one single application.
  - True
  - False
- The EPA regulates all liquid chemical disinfectants used on noncritical surfaces. The Food and Drug Administration (FDA) regulates any high-level disinfectants and sterilants.
  - Both statements are True.
  - The first statement is True, the second False.
  - The first statement is False, the second True.
  - Both statements are False.
- The EPA does not consider tuberculocidal activity (intermediate-level or low-level disinfectants as classified by CDC/FDA) and registers environmental surface disinfectants based on the manufacturer's microbiological activity claims when registering its disinfectant.
  - True
  - False
- With the two-step product, the surface must:
  - First be cleaned with a detergent.
  - Be wiped to physically remove bioburden or other debris (pre-cleaning) that might interfere with disinfection.
  - Receive a second spray with an EPA-registered liquid chemical germicide to disinfect.
  - Remain in contact with the surface for the contact time stated on the disinfectant's label.
  - All of the above

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## Surface Disinfection in the Dental Office By Louis G. DePaola, DDS, MS

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