Environmental Surface Barriers

Published: March 23rd, 2023

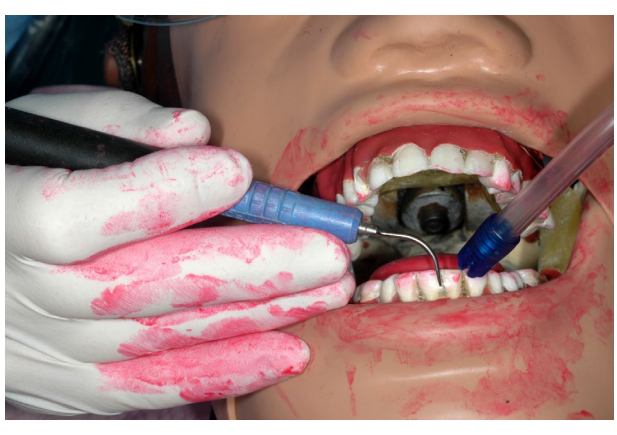
Cross-contamination and cross-infection can occur by direct contact with microorganisms, indirect contact with contaminated objects, droplet transmission, and inhalation of airborne pathogens. Regarding clinical environmental surfaces in health care settings, these sites may not always be optimal for microbial survival and multiplication, but they can still play a role in cross-infection based on their location and potential to transmit pathogens. Surfaces close to a patient and those that are frequently touched without the use of effective infection control precautions can present a potential for infection in patients and health care workers alike. Hospital studies in the 1970s and 1980s suggested that environmental surface contamination played only a minor role in the endemic transmission of health care-associated infections. However, investigations later showed that a number of nosocomial pathogens could be shed by patients, survive on surfaces for extended periods of time, contaminate hospital surfaces at concentrations sufficient for transmission, and persist despite attempts to disinfect or remove them.[1-5] As a result, evidence from clinical studies has established that nosocomial pathogens may well survive or persist on surfaces for months and can thereby be a continuous source of transmission if no regular preventive surface disinfection is performed (Table 1).[1-6]

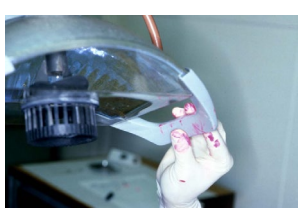
Table 1. Representative Microbial Persistence on Dry, Inanimate Surfaces

Microorganism	Duration of Persistence
Staphylococcus aureus, incl. MRSA	7 days – 7 months
Enterococcus sp. (incl. VRE)	5 days – 4 months
Escherichia coli	1.5 hrs. – 16 months
Acinetobacter spp.	3 days – 11 months
Respiratory Syncytial Virus (RSV)	Up to 6 hrs.
Clostridium difficile	> 5 months
Influenza viruses	1 – 2 days
Rhinoviruses	2 hrs. – 24hrs.
Herpes simplex viruses (HSV)	4 hrs. – 8 wks.
Hepatitis B Virus (HBV)	> 1 wk. (in blood)
Hepatitis C Virus (HCV)	16 hrs. – 6 wks. (in blood)
Hepatitis A Virus (HAV)	2 hrs. – 2 months
Noroviruses	8 hrs. – 2 weeks

As examples, accumulated findings indicated that contaminated surfaces in these settings played important roles in the epidemic and endemic transmission of Clostridium difficile, vancomycin-resistant enterococci, methicillin-resistant Staphylococcus aureus, Acinetobacter baumannii, Pseudomonas aeruginosa, and noroviruses. Fortunately, reports also specified that the prevention and control of outbreaks were substantially increased when appropriate environmental decontamination procedures were utilized.[3-7]

In dentistry, operatory surfaces can routinely become contaminated with patient saliva, blood, and other fluids during treatment. The overwhelming majority of reports implicating environmental surfaces in microbial infections have documented cases in medical facilities. In contrast, much less information is available to confirm cross-infection via this route to dental health care workers or their patients. As a result, the data on medical facilities should be used as the basis for cross-contamination protection in a dental office environment.[8]





Classification of Environmental Surfaces

There are two categories of environmental surfaces: clinical contact surfaces and housekeeping surfaces. These require different infection control practices based on the potential for direct patient contact, degree and frequency of hand contact, and potential contamination of the surface with body substances or pathogens.
Clinical contact surfaces are defined as surfaces that can act as reservoirs for microbial contaminants with the potential to transmit infection because they can be directly contaminated from patient materials either by direct spray or spatter or by (gloved) hand or instrument contact. Examples include light handles, switches, dental chairside computers, telephones, and countertops. These surfaces should be covered with disposable single-use barriers to prevent contamination or cleaned and disinfected with a low- to intermediate-level disinfectant.

In contrast, housekeeping surfaces, such as floors, walls, and sinks, have limited risk of disease transmission and can be decontaminated with less rigorous methods. They are required to be cleaned only. According to the 2003 CDC infection control guidelines for dentistry, “evidence does not support that housekeeping surfaces (e.g., floors, walls, and sinks) pose a risk for disease transmission in dental health-care settings. Actual, physical removal of microorganisms and soil by wiping or scrubbing is probably as critical, if not more so, than any antimicrobial effect provided by the agent used. Most housekeeping surfaces need to be cleaned only with a detergent and water or an EPA-registered hospital disinfectant/detergent, depending on the nature of the surface and the type and degree of contamination.”[9]

It must be emphasized that limiting environmental surface cross-contamination from blood and bodily fluids is a fundamental principle of dental infection control. Thus, using disposable barriers and chemical disinfectants is appropriate when it is not possible to sterilize all items and surfaces contaminated during patient treatment.[9] To prevent this type of environmental cross-contamination, the following precautions should be taken: (1) prevent contamination by using barriers, (2) clean and disinfect contaminated surfaces, (3) implement aseptic protocol, (4) remove unnecessary items from treatment areas.[8]

Environmental Surface Barriers

Barrier protection of surfaces and equipment can prevent contamination of clinical contact surfaces. A primary purpose of surface barriers is to prevent contamination of a surface or equipment, but it is also to reduce the need to clean and disinfect that surface or equipment before reuse. These covers should be used for noncritical equipment surfaces that are: (1) touched frequently with gloved hands during patient care, (2) likely to become contaminated with blood or body substances, or (3) hard to clean and disinfect between patients. Examples of surfaces suitable for barrier coverage are switches, light handles, computers and keyboards, radiograph equipment, countertops, pens, telephones, and other knobs and handles. CDC, ADA, and other infection control guidelines stress the importance of using single-use, impermeable surface barriers to prevent the contamination of selected clinical contact surfaces rather than cleaning and disinfecting every surface after each use.[2] Given the time limitations and many demands on dental workers, the potential for inadequate decontamination increases when surfaces are difficult to clean and/or disinfect due to surface irregularity or complexity. Instead, these can be covered to promote environmental asepsis more efficiently between patients. Using barriers correctly is also more reliable, saves time, reduces exposure to chemicals, and is visible to the patient.

Factors to Consider When Choosing and Using Surface Barriers

Key points for the successful use of environmental surface barriers are:

1. Cover surfaces that are most used and/or most difficult to clean.
2. Select impermeable disposable materials, such as plastic.
3. Consider adhesive materials, shapes designed for specific equipment or items, or universal shapes with multiple uses.
4. Train workers to place and remove barriers after each use aseptically, without contaminating surfaces or themselves with contaminated sides of used barriers. Gloves should be worn to remove contaminated barriers.
5. Establish a reasonable and consistent protocol for cleaning and disinfecting contaminated clinical, barrier-covered, and exposed surfaces.[8]

Benefits and Disadvantages of Using Surface Covers

The adaptation of certain surface covers depends on the evaluation of potential advantages and disadvantages for their inclusion in an overall infection prevention program. These are summarized as follows:[10]

ADVANTAGES	DISADVANTAGES
Prevent cross-contamination	Need a variety of sizes and types
Protect difficult-to-clean surfaces	Some plastic items are non-recyclable and non-biodegradable
Less time-consuming than cleaning and disinfection	Undesirable aesthetic appearance for some
Reduces use of potentially harmful chemicals	Additional costs over chemical sprays and wipes

Mistakes to Avoid When Using Disposable Barriers in Practice

Recognizing and avoiding mistakes involving surface covers is important for successful infection control protocols. Examples of misuse include:

- ***Reuse of barriers:*** They are approved, advertised, and sold as single-use, and they should be replaced after one use.
- ***Cross-contamination of surfaces by contact during removal of used barriers:*** Aseptic techniques should be practiced when placing and removing barriers to avoid the need to clean and disinfect covered surfaces after each use.
- ***Use of absorbent or permeable barriers:*** Only environmental barriers that have been tested and shown to be impermeable can predictably protect a surface or item.

Summary

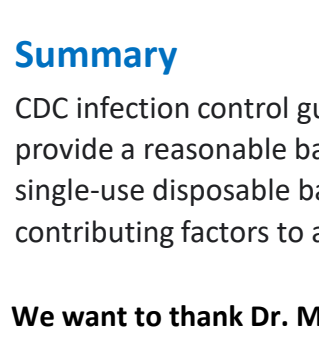
CDC infection control guidelines address the relatively low infection risk from environmental surfaces and provide a reasonable barrier, cleaning, and disinfectant approaches for minimizing cross-contamination. Using single-use disposable barriers in key areas, along with appropriate application surface disinfectants, are major contributing factors to a complete and effective dental infection prevention program.

We want to thank Dr. Molinari, and we invite you to evaluate our wide range of products designed to protect clinicians, patients, and the practice during dental procedures. For more information, visit palmerohealth.com, call 800-344-6424 or email customerservice@palmerohealth.com.

References

1. Maki, DG, Alvarado CJ, Hassemer CA, et al. Relation of the inanimate hospital environment to endemic nosocomial infection. New Engl J Med 1982; 307: 1562-1566.
2. McGowan, JE Jr. Environmental factors in nosocomial infection: a selective focus. Rev Infect Dis 1981; 3:760–769
3. Boyce J. Environmental contamination makes an important contribution to hospital infection. J Hosp Infect 2007; 65:50-54
4. Weber DJ, Rutala WA, Miller MB, et al. Role of hospital surfaces in the transmission of emerging health care-associated pathogens: Norovirus, Clostridium difficile, and Acinetobacter species. Am J Inf Cont 2010;38: S25-S33
5. Otter Ja, Yezli S, French G. The role played by contaminated surfaces in the transmission of nosocomial pathogens. Infect Cont Hosp Epid 2011; 32:687-99
6. Kramer A, Schewebke I, Kampf G. How long do nosocomial pathogens persist on inanimate surfaces? A systematic review. BMC Infect Dis 2006; 6:130-137
7. Suleyman G, Alangaden G, Bardossy AC. The role of environmental contamination in the transmission of nosocomial pathogens and healthcare-associated infections. Curr Inf Dis Rpts 2018;20:12 https://doi.org/10.1007/s11908-018-0620-2
8. Molinari JA and Andrews N. Putting a stop to cross-contamination. Dimension Dent Hyg 2004 ;
9. CDC. Guidelines for infection control in dental healthcare settings. Morbid Mort Wkly Rpt. 2003: 52(RR-17):1-66
10. Molinari JA and Harte JA. Environmental surface infection control: disposable barriers and chemical disinfection. In Cottone’s Practical Infection Control in Dentistry Chap. 12, p. 171-184. (Wolters Kluwer/Lippincott Williams & Wilkins (3rd Ed.). Philadelphia (2010)

Author



John A. Molinari
Ph.D.

Dr. John A. Molinari is Professor Emeritus at the University of Detroit Mercy, where he served for 32 years in the School of Dentistry as Professor and Chairman of the Department of Biomedical Sciences and Director of Infection Control. He also has been Infection Control Director for THE DENTAL ADVISOR in Ann Arbor, Michigan. Dr. Molinari is a founding member and Past-President of OSAP. He has published over 500 scientific articles, text chapters, and abstracts in the areas of microbiology and immunology, and lectures nationally and internationally on topics dealing with infectious diseases and infection control. Dr. Molinari is also co-author of the text *Cottone’s Practical Infection Control in Dentistry.*