Summary of Current Dental Surface Disinfection Protocols and a Review of the New 1 Minute Surface Disinfectants CaviCide1 and CaviWipes1

Nancy Andrews, RDHBS  
Noel Kelsch, RDHAP  

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Introduction

The risk of contracting a serious infection while providing or receiving medical or dental care, is a compelling concern for millions of patients and dental workers – a concern generated by media reports of healthcare-associated infections and deaths. Environmental asepsis, including the removal and destruction of pathogens before they infect workers or patients is a vital component of clinical safety. Knowing the properties of products and optimal techniques for effective surface cleaning and disinfection empowers the dental workers, builds trust and promotes safety.

Risk of Infection in Dental Settings:

Disinfection of contaminated environmental surfaces and objects in all healthcare settings is an ongoing challenge and important aspect of infection prevention and patient safety. Healthcare-associated infections (HAI) are primarily caused by viruses, fungi, bacteria acquired while receiving treatment for other conditions. Most investigations of HAIs are conducted in medical environments, but serve as a model for understanding and controlling infections in dental settings. Safety practices in dentistry are modeled after those in medicine due to scientifically validated risk assessments; while the exact pathogens and conditions may differ, the principles of infection control are reliable. [1 , 1-A].

What Information is Trustworthy?

Reliable Dental Safety Guidelines: The most reliable sources for guidance are the Centers for Disease Control (CDC), members of the research, education and science community such as accredited Universities, approved testing facilities, and official agencies including the United States Food and Drug Administration (FDA), Environmental Protection Agency (EPA), or professional organizations utilizing peer-review and scientific processes such as Organization for Safety and Asepsis & Prevention. Centers for Disease Control Dental Infection Control Recommendations are based on information learned in medical settings, adapted for dental care.

The Role of Surface Contamination in Disease transmission: Infectious pathogens are transmitted by direct contact, indirect contact, ingestion, percutaneous exposure and mucosal absorption. Diseases are categorized as contact diseases, droplet diseases, airborne diseases and bloodborne diseases. It is important to consider the type of organisms encountered in dental settings and their possible routes of transmission. Pathogens that can be transmitted by contaminated surfaces must be able to survive on those surfaces, be transferred to workers or patients directly or indirectly, and may enter new hosts through non-intact skin, mucosal or ocular exposure, or ingestion, and in some circumstances, inhalation. [1]
Levels of chemical disinfection: Microorganisms vary greatly in their resistance to chemical germicides. Spaulding proposed three levels of disinfection for the treatment of devices and surfaces that do not require sterility for safe use. The disinfection levels are “high level,” “intermediate-level,” and “low-level.” These levels relate to the spectrum of organisms targeted by each category of chemical germicidal agents. High-level disinfectants are used for instruments and devices, require extended contact time, and are not safe or effective for environmental disinfection. Environmental surface disinfection is accomplished with low or intermediate-level disinfectants. [1]

In order to destroy the targeted microorganisms, the user needs to employ exposure times and a concentration of the appropriate germicide needed to achieve complete destruction before the pathogens infect people. Manufacturers of approved medical and dental surface disinfectants specifically list the organisms on product labels that the product has been tested against, and the use-directions (including contact time) needed to kill or deactivate the pathogen. [1] [1-A] [2]

TB is a “benchmark organism,” used to demonstrate the effectiveness of a surface disinfectant. Disinfectants that are effective against TB are also presumed effective against “weaker organisms.” Intermediate-level disinfectants are effective against TB, while low level disinfectants are not. Intermediate-level disinfectants provide a broader spectrum of antimicrobial action, and a greater margin of safety than low level disinfectants. “TB kill time” is the contact time needed for a disinfectant to destroy TB. Products must remain wet on surfaces for the time stated on their label to achieve reliable disinfection. [1,3]

Representative Pathogens Destroyed by Intermediate-level Surface Disinfectants and Significance in Dental Settings

Surface disinfectants are developed for use in various medical settings. Dental environments are less likely to be contaminated with some organisms that may be seen in hospitals because dental patients should be screened for symptoms of infective diseases such as febrile respiratory illnesses or acute gastrointestinal infections. Since subclinical cases may be undetected, dental workers should always select surface disinfectants that are effective against a broad spectrum of pathogens. [1-A] [2]

What is an EPA disinfectant? The Environmental Protection Agency (EPA) registers pesticides and protects people and the environment by regulating safe use and disposal of chemicals. Every pesticide (including disinfectants and sanitizers) sold in the United States must be registered with the EPA. The EPA registration number can be found on the label. It is a violation of Federal Law to use an EPA registered product in a manner inconsistent with its printed directions. Off label use can render a product inert or ineffective, or pose personal or environmental risks. Note: product labels are continually updated as new research is done and should be read prior to use. [4]

Overview of Chemical Agents Used for Hard, Non-porous Surface Disinfection

There are several different types of antimicrobial agents that can be used to achieve hard non-porous surface disinfection. The chemical agents can affect microorganisms through different mechanisms, such as disruption of the bacterial cell wall and outer membranes, as chelators, or preventing the organism from replicating. The ideal surface disinfectant would be broad spectrum, fast acting, active in the presence of organic matter (effective in a “one-step” protocol), non toxic, nonallergenic, non-damaging to surfaces such as metal, cloth, rubber or plastics, leave no residual effect on treated surfaces, be easy to use and be low cost. Unfortunately, there is no ideal surface disinfectant. Each
product has some limitations, but if users know the active ingredients and features of their product they can maximize the features that are important for their use and setting. [3]

Some opinion leaders have indicated that adequate surface disinfection can be achieved from one application, allowing the surface to dry within one minute. However, not all products are made the same, and thus, this theory does not apply to all disinfectants. Eliminating the cleaning step and allowing only one minute contact time can be a deviation from the product label and can introduce a risk of inadequate disinfection unless the surface is truly clean and the product has an approved 1-minute TB kill time. [1,3]

**Efficacy and Practical considerations of Quaternary Ammonium- Alcohol Products**

Quaternary Ammonium compounds (Quats) with moderate to high-levels of alcohol are the most frequently used disinfectants in dentistry. Quaternary ammonium compounds are cationic detergents that kill pathogens by inactivating energy-producing enzymes, denaturing essential cell proteins, and disrupting cell membranes, thus changing the cells permeability resulting in a loss of essential cytoplasmic constituents such as potassium. [4,5] Quats are highly effective against gram-positive bacteria and less active against gram-negative bacteria. When mixed with alcohol, the synergistic affect results in accelerated and more effective disinfection. The combination of quaternary ammonium-alcohol is lethal to even some of the most resistant organisms, including Mycobacterium tuberculosis.

The percentage of quaternary ammonium and alcohol may vary by manufacturer, and the percentage is specified in parts per million (ppm) and listed in the product’s MSDS. Because alcohol has rapid action against microorganisms, the higher percentage of alcohol in the chemical formulation generally contributes to the faster kill times. [6] For example, a 55% isopropyl alcohol and 0.5% quaternary ammonium chloride formulation is fungicidal, bactericidal, virucidal, and tuberculocidal, killing 26 microorganisms in two minutes or less. Conversely, however, some quaternary ammonium-alcohols with higher alcohol concentration (above 55%) list a 10 minute TB kill time.

**Clinical Evaluation: Cleaning Capability of a New Product**

Soils and bioburden can prevent effective surface disinfection. The soils encountered in dental and medical applications, such as blood and mucus, tend to have high concentrations of proteins and fats which can interfere with the surface disinfectant liquids by preventing contact with the surfaces which require disinfection. The disinfecting liquid may be blocked by the soil from wetting the surface, protecting the microorganisms from inactivation, and the soil itself may harbor pathogens. The primary task of surface disinfectants is to disinfect hard, non-porous surfaces. A well designed surface disinfectant product should solubilize (clean) the soil prior to wiping, and not promote soil binding to the surface. Pre-saturated wipes are a popular alternative to spray liquids because they are a superior way of decreasing microbial bioburden on surfaces when used properly, and reduce aerosolization of chemicals and excess pooling of liquids. [7]

In response to the expressed need for a reliable disinfectant with the combined qualities of rapid TB effectiveness, and excellent cleaning ability, recent studies and product reformulation of CaviCide and CaviWipes were completed. The active ingredients in CaviCide and CaviWipes are quaternary ammonium and low levels of alcohol. CaviCide1 and CaviWipes1 have slightly higher alcohol content and a 1 minute TB contact time. Products with a moderate to high alcohol content have previously been shown to demonstrate poor cleaning capabilities compared to low alcohol disinfectants due to alcohol's tendency to precipitate proteins on surfaces.[8] CaviCide1 and CaviWipes1 were evaluated for cleaning effectiveness.
In addition to being EPA approved intermediate-level disinfectants, CaviCide1/CaviWipes1 have indications for disinfection of non-critical medical devices and are also regulated by the United States Food and Drug Administration (FDA) as medical devices. CaviCide1/ CaviWipes1 can be used to clean semi-critical or critical medical devices prior to appropriate high-level disinfection or sterilization.

**Conclusion of CaviCide / CaviWipes1 studies:** CaviCide1 and Caviwipes1 are effective cleaners in the presence of organic matter such as blood and sputum. These products may be used for cleaning as well as disinfection without the need to select a separate pre-cleaning product. The contact time for disinfection is 1 minute, which matches the clinical needs of dental workers. The demonstration test indicates that on essentially clean surfaces that are not contaminated with gross debris or materials, CaviCide1 and Caviwipes1 can be expected to achieve reliable disinfection in one step. However, following CDC recommended best practices, and providing the highest margin of safety and reliability, CaviCide1 and Caviwipes1 should be used in the recommended protocol of two steps: cleaning step followed by a disinfecting step.

**Overview of Compatibility Testing**
CaviCide1 solution was tested and found to be compatible with the most materials found in the dental setting including: acrylic, PVC, epoxy countertops, brass, glass cooper, silicon, stainless steel, neoprene, acrylic, polystyrene, naugahyde, Formica, etc. Materials were exposed to 14 days (336 hours) of continuous contact with CaviCide1 with little (slight darkening, lightening or spotting on four of the 19 materials tested) or no effect.

**CaviWipes1 Evaluation Results Discussion:** Tests demonstrated that the both CaviCide1 and CaviWipes1 clean efficiently and effectively in the presence of organic soil. This finding allows the products to be utilized effectively as both a cleaner and a quick acting disinfectant. Pre-cleaning with a separate product is not necessary. The one-minute contact time eliminates the need to spend time extra time between patients waiting for the disinfection process to occur. These products were found to be compatible with most materials that make up the surfaces that must be disinfected in dentistry.

**Conclusion**
Disinfection of contaminated environmental surfaces and objects in all healthcare settings is an ongoing challenge and important aspect of infection prevention and patient safety. Environmental asepsis, including the cleaning and disinfection is a vital component of clinical safety against a growing list of infectious diseases. The risk of exposure to pathogens, including resistant organisms such as MRSA, in dental settings is proven. Dental workers must understand and follow product use-directions to prevent clinical infections. Optimal features of a surface disinfectant include rapid effectiveness against TB along with excellent cleaning capability while not harming office materials. Two new products, CaviCide1 and CaviWipes1 have a rapid (1 minute) TB contact time. They were evaluated for cleaning ability and compatibility with environmental surfaces and found to demonstrate excellent cleaning ability and material compatibility.
References:


About TotalCare

TotalCare is a division of Metrex Research LLC. Our corporate headquarters is located in Orange, California, and our state-of-the-art manufacturing facility is in Romulus, Michigan. At TotalCare, we're all about protecting people by providing high-quality infection-prevention products, including a complete line of pre-cleaners and enzymatic detergents, high-level disinfectants, surface disinfectants, liquid medical waste disposal products, eye protection and hand hygiene products. TotalCare products are sold through leading dental and medical product suppliers around the globe. To contact a TotalCare representative, call 800.841.1428 or visit totalcareprotects.com