Practice disinfection

Tim Sandle reviews the effectiveness of alcohol wipes.

Regular disinfection of dental practice surfaces is a key feature of infection control, helping to prevent the transfer of contamination in between patients, and between patients and practice staff. The wiping down of surfaces between patient treatments is recommended by the General Dental Council (GDC).

There are a range of different disinfectants with different active ingredients available. The choice of active ingredient affects the spectrum of kill the disinfectant possesses (the range of different microbial types that can be killed). Other factors affecting selection include safety; contact time (how long the surface needs to be left for, following disinfection); and format (with most practices preferring pre-saturated wipes).

One of the most widely used types of disinfectant is alcohol, because of its wide spectrum of microbial kill. Unlike some other types of disinfectants, alcohol-based biocides can destroy the bacteria responsible for tuberculosis (*Mycobacterium tuberculosis*) and for MRSA (antibiotic resistant forms of *Staphylococcus aureus*), provided they are applied with a suitable wiping technique. An alternative disinfectant class are quaternary ammonium compounds 'quats', however these are effective against a narrower range of microorganisms. For example, quats are ineffective against the tuberculosis bacterium. They can also be affected in the presence of hard water or when in contact with materials like cotton or gauze pads.

This article outlines the effective use of alcohol based disinfectants within the context of dental practice surfaces, together with appropriate tips for their application.

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Alcohols

Alcohols are effective at eliminating vegetative bacteria and viruses from surfaces. The antimicrobial effectiveness of alcohol is through damage to bacterial cell membranes and subsequent denaturation of cellular proteins. Alcohols are effective against microorganisms associated with the skin, as well as pathogens like *Escherichia coli,* together with *M. tuberculosis*. With tuberculosis bacteria in particular, alcohols are frequently cited as the disinfectants of choice.

There are a range of different types of alcohol (differentiated by molecular weight) and not all of them are suitable to be used as disinfectants. For example, methanol has a weak bactericidal action and would not be recommended for a dental practice. A more effective alcohol is isopropyl alcohol (IPA), which is fast acting and possesses a broad-spectrum antimicrobial activity. When alcohols are used in combination, such as IPA and ethanol, the antimicrobial action is arguably greater. This is because IPA is slightly more efficacious against bacteria, whereas ethanol is more potent against viruses. The combination of the two makes for an effective disinfectant product.

An important factor with alcohols is the concentration, with alcohols falling within a concentration range of 60-80 per cent in water (volume/volume) being the most efficacious (with a typical commercial concentration of 70 per cent).

Protein fixation

Reference is sometimes made to alcohols binding protein (like blood and pus) on surfaces like stainless steel. This can occur through a chemical reaction called 'fixing' (protein denaturation) whereby the molecular shape of the protein molecule alters.

However, to state that all alcohols fix protein to all surfaces in all circumstances is an over-simplification. Much of what has been written about

protein fixation is based on what happens when protein is fixed to a microscope slide (here alcohol, at a higher concentration of 80 per cent, after an extended contact time, causes proteins to precipitate). For protein fixation to occur the alcohol needs to be in contact with the surface protein for a prolonged period of time (in excess of one hour) and for alcohols of a high concentration (around 90 per cent) to be used.

The extent that fixation occurs also varies depending upon the type of soil and the type of surface (the degree that it adheres to surfaces is dependent upon electrostatic interactions with that surface). For example, protein fixation that might occur with the surface materials used as practice surfaces (such as Formica) will differ to stainless steel dental instruments. Differences relate to strength of binding and likely contact time, both of which are weaker (as with binding) and shorter (as with contact time) with practice surfaces. For this reason, different protocols are needed for the disinfection of instruments and bench surfaces.

Furthermore, the forms of alcohol that are sometimes cited as being of concern are not industry standard. Alcohols diluted to 60-80 per cent are prepared so that the disinfection activity takes place more slowly, which allows the alcohol to enter the cell. Moreover, alcohols in studies shown to be protein fixing invariably do not contain added surfactant.

Importantly protein fixation is not considered to be a concern with alcohol based wipes, when applied to the common types of surface found in dental practices. This is provided that:

- The area which is exposed to blood is disinfected promptly;
- The alcohol is applied using a wipe (either pre-saturated or using a spray and wipe);
- More than one wiping action is used (typically a surface will be wiped at least twice);
- The disinfected surface is left for a recommended time ('contact time') before use. Typically this is one minute, although the time will be recommended by the manufacturer.

These factors should be assessed against an appropriate disinfectant efficacy standard provided by the manufacturer of the product. A suitable standard for wipes is EN 13697:2015. Disinfectant efficacy tests are conducted under simulated 'clean' and 'dirty' conditions. Dirty conditions are designed to simulate the presence of 'soil' (like grease or blood protein). When reviewing studies it is important that the soil used is representative of the types found within the practice rather than a substitute soil like bovine albumin. Another point to note is the contact time. An example of a study using alcohol wipes featured in the October 2014 edition of *The Dentist*; this study demonstrated that industry standard alcohol wipes are effective for killing the microorganisms of concern in the practice setting.

Cleaning and wiping

Where soil is present on a surface, cleaning is required prior to disinfection (or, optimally, a disinfectant that contains a detergent is used). This is because many disinfectants have a limited capacity to penetrate soil and make contact with the microbial cell. Therefore, any remaining concerns with protein can be further overcome when alcohol-based disinfectants containing surfactants are used (as is the case with some proprietary alcohol wipes.) Here the surfactant reduces the surface tension and prizes-apart the protein from the microorganisms, allowing the disinfectant to make contact with the microorganisms and destroy the microorganism.

In addition, microorganisms bound to surfaces (such as the dental practice work surface) behave differently to microorganisms in a free-floating state (such as in water) and are far more resistant to antimicrobial agents. This is because slime produced by bacterial communities prevents the perfusion of biocides to bacterial cell targets. To overcome this, effective wiping in at least two motions, is needed. This means the combination of a disinfectant-detergent plus the physical force of wiping are the key requisites for effective disinfection.

Summary

This article has provided an overview of the efficacy of alcohol-based disinfectants, considering the typical types found within the dental practice. One concern raised with alcohols is the phenomenon of protein fixation and the effect of this on the ability of the disinfectant to achieve adequate microbial kill. This remains theoretical due to the timescales required for fixation, which are unlikely to occur in practical situations; as a safeguard, the use of effective wiping techniques and the selection of alcohol based disinfectants that contain added surfactants, will overcome any risk of this effect. Taking account of these factors leads to the conclusion that alcohol based disinfectants are among the most appropriate for use in the dental setting.

References available on request.