

Hypochlorous acid as a disinfectant for high-risk HPV: Insight into the mechanism of action

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Medical instruments that are not autoclavable but may become contaminated with high-risk human papillomaviruses (HPVs) during use must be thoroughly disinfected to avoid the possibility of iatrogenic transmission of infection. There is an expectation that prolonged soaking of instruments in the United States Food and Drug Administration-cleared chemical disinfectant solutions will result in high-level decontamination, but HPV16 and HPV18 are known to be resistant to commonly used formulations. However, they are susceptible to a variety of oxidative agents, including those based on chlorine. Here, we tested the efficacy of homogeneous hypochlorous acid (HOCl) solutions against mature infectious virions of HPV16 and HPV18 dried onto butadiene styrene coupons and ultrasonic probes. Both viruses were inactivated to >4 log reduction value after 15 seconds on spore coupons and 5 min on ultrasonic probes. Morphologic changes became evident within those contact times by transmission electron microscopy when HPV16 virus-like particles were exposed to HOCl under identical conditions. Mass spectrometry analysis of trypsin-digested products of L1 capsid proteins exposed to HOCl showed that mostly conserved residues were modified by oxidation and that these changes rapidly lead to instability of the protein demonstrable on sodium dodecyl sulfate-polyacrylamide gel electrophoresis (SDS-PAGE). Modifications to these residues may contribute to rapid virus inactivation.

The use of homogeneous HOCl solutions for HPV decontamination provides a highly effective means of assuring the safety of nonautoclavable medical instruments.