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Revisiting Handwashing – As It Is Absolutely Essential

Graham H. Litchman DO MS,[a] Justin W. Marson MD,[b] Neal Bhatia MD,[c] Brian Berman MD PhD[d]

[a]Department of Dermatology, St. John's Episcopal Hospital, New York, NY
[b]National Society for Cutaneous Medicine, New York, NY
[c]Therapeutics Clinical Research, San Diego, CA
[d]University of Miami Miller School of Medicine, Miami, FL and Center for Cosmetic and Clinical Research, Aventura, FL

ABSTRACT

As the coronavirus pandemic continues into the second half of 2020, states across the US remain steadfast in their search to determine the safest methods of returning to normalcy. Without a readily available, effective COVID-19 vaccine, and as the numbers of infected individuals continues to climb, the best practices to ensure public safety are rooted in good personal hygiene and prevention of transmission of the novel coronavirus SARS-CoV-2. To that end, in addition to properly wearing adequate facial covering, individuals should properly wash their hands to prevent direct auto-inoculation.

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INTRODUCTION

Despite being a technique widely taught from primary school-age, many individuals do not practice adequate hand hygiene and, even pre-pandemic, suffered from economic losses of missed days at work and/or school.[1] Study data have shown that the simple act of handwashing, regardless of other medical interventions, can reduce the transmission of respiratory viruses.[2] Furthermore, handwashing with an adequate antimicrobial product for at least 20 seconds can reduce the risk of transmission of viruses, including respiratory viruses like SARS-CoV-2.[1,3,4] Consistent use of water and soap or alcohol-based sanitizer has been estimated by the World Health Organization (WHO) to reduce pathogen spread up to 50% among healthcare workers.[5] Newer studies are now focusing on "virucidal" properties of alternative and novel agents and combinations.[1]

Sodium hypochlorite (chemically known as NaOCl and more commonly referred to as "Liquid Bleach"), is a chlorine-derived product, that has been used as a disinfectant for over 200 years, and came to prominence in the 1930s. Open wounds were treated with hypochlorite solutions during World War I, which lead to more routine use within hospitals.[6] This paired with aggressive marketing, ultimately lead to "Clorox" becoming the household name for a disinfectant.

The antimicrobial effects of these chlorine-derived products comes from their ability to disrupt the membranes of bacteria, fungi, and viruses as well as induce oxidative damage to the necessary proteins and enzymes for microbial survival.[7] The strengths of chlorine-derived agents are determined by their concentration and the solvent (typically water) in which they are mixed. When NaOCl is added to water the reaction yields hypochlorous acid ion (HOCl) and sodium hydroxide (NaOH) (Figure 1).[5] Because NaOCl is more stable, it usually predominates at equilibrium. However, in more acidic solvents, the concentration of HOCl increases. This increases the potency of the solution's antimicrobial properties given that HOCl is 80–120 times more efficient at eliminating bacteria, viruses, and fungi than sodium hypochlorite.[8,9] Hypochlorous acid on its own is far too caustic and is not appropriate for application to the skin or human body; consequently, it is reserved for disinfecting inanimate objects, demonstrating that its strength comes at a price.[5]

While HOCl may be too caustic in direct applications, modulation of the concentration of the solvent and pH to a more basic 6% sodium hypochlorite dissolved in over 120 liters of water (or a bleach bath) is a corner stone of controlling bacteria levels in patients with atopic dermatitis.[10] Although data on twice weekly bleach baths shows mixed results, newer, less concentrated formulations of NaOCl-based products, including a daily body wash,[11] not only decrease bacterial loads, but are also well-tolerated on skin and far easier to use on a regular basis. Additional studies demonstrated that NaOCl was efficacious in a concentration-dependent manner where a 0.25% solution removed 99.97% of detectable viral particles from the hands[3] after contact time of 15–30 seconds, within the handwashing-timeframe recommended by the CDC.[3,12,13] Furthermore, a recent study has demonstrated reduced detection of Coronavirus by ≥3.50 log10 (≥99.97%) following a 15-second exposure to a 0.006% sodium hypochlorite wash.[13]

FIGURE 1. Chemical reaction between sodium hypochlorite and water. The reaction generally favors the more stable sodium hypochlorite. In more acidic conditions the reaction shifts the equilibrium to the right, producing slightly more of the more potent hypochlorous acid

$$NaOCl + H_2O \rightleftharpoons HOCl + NaOH$$

Various other products have also been examined, some of which utilize active ingredients such as quaternary ammonia salts and phenolic compounds, and are effective after 1 to 10 minutes of contact, depending on preparation (Table 1).[5] While potent, these agents are relegated to surface decontamination of inanimate objects as they can instigate an inflammatory reaction in the mucous membranes as well as the skin.[14] At this time, the more common agents used for handwashing are alcohol-derived products and classic soap and water. Alcohol-based disinfectants with a concentration between 50–90% function by disrupting requisite microbial cell membrane proteins and are highly efficacious in eliminating unwanted microbes.[5] However, overexposure to alcohol-based disinfectants from repetitive applications can deplete the skin of necessary fatty acids, disrupting normal barrier function leading to irritant contact dermatitis.[5] Soap and water are highly effective in decreasing microbial load, however their virucidal properties are highly dependent on the chemical composition of their fatty-acid components.[5] While soap and water do not have the same risk profile for irritant contact dermatitis (unless used in excess) their usage is typically limited by access to running water.[2,5]

TABLE 1.

Common components of virucidal sanitizing agents ranked by increasing reported contact time (ie, time needed for application to maximize antimicrobial activity) of the primary active compound. Note how in combination with additional agents/solvents, the contact time can be dramatically lowered and also change the safety/tolerability profile for use on skin.

Sanitizing Agent	For Surfaces	For Skin*	Contact Time** (mins)[5]	Limitations for Topical Use[15]
Ethanol (EtOH)	+	+	0.5	Irritant contact dermatitis, mucocutaneous irritation, flammable
WHO-I (EtOH 85% v/v, Glycerol 0.725% v/v, Hydrogen Peroxide 0.125% v/v)		+		
WHO-II (Isopropanol 75% w/w, Glycerol 0.725% v/v, Hydrogen Peroxide 0.125% v/v)		+		
Hypochlorous Acid	+		0.5	Mucocutaneous irritation, blistering/burns
Silver Ion, Citric Acid	+		1	Mucocutaneous irritation
Peroxyacetic Acid	+		1	Mucocutaneous irritation, blistering/burns, flammable
Hydrogen Peroxide	+	+	5	Mucocutaneous irritation, skin discoloration, swelling
+ Peroxyacetic Acid	+		1	
+ Ammonium Carbonate, Ammonium Bicarbonate	+		5	
Sodium Hypochlorite	+		10	Redness, pain
6% v/v + Sodium Carbonate	+		0.5	Redness, pain
0.25% g/g		+	0.5	
0.006% solution		+	0.25-0.5	
Quaternary Ammonium	+		10	Mucocutaneous inflammation, possible allergenic potential
+ Ethanol	+		1	
+ Isopropanol	+		0.5	
Phenolic Acid	+		10	Potential mutagen, mucous membrane irritation, reproductive toxicity
Sodium Chlorite	+		10	Redness, pain

*Composition/concentration dependent
**Contact times based for surface disinfectant use

Effective handwashing is capable of not only reducing the pathogenic load on an individual's hands but also preventing illness, thereby theoretically reducing significant economic fallout. The key to harnessing this tool lies in not only practicing proper technique for the recommended 20 seconds, but also utilizing appropriate agents to sufficiently decrease the viral load that individuals may unwittingly carry. Age-old therapeutics are being researched, refashioned, and recombined into newer fungicidal, bactericidal, and virucidal agents for use in our surroundings and on our persons. Pandemic or not, handwashing has proven time and time again to be a public health cornerstone for maintaining the well-being of oneself and of the community.

CONCLUSIONS

A key habit to reduce risk of infection while maintaining healthy skin must include proper disinfection with safe, gentle, and effective topical cleaning products that are not only quick and accessible, but also are safe and carry few, if any, adverse effects.

DISCLOSURES

Dr. Berman is a member of the scientific advisory board – TopMD. The other authors have no relevant conflicts to declare.

REFERENCES

1. Prater KJ, Fortuna CA, McGill JL, et al. Poor hand hygiene by college students linked to more occurrences of infectious diseases, medical visits, and absence from classes. *Am J Infect Control.* 2016; 44(1):66-70. doi:10.1016/j.ajic.2015.08.012
2. Najnin N, Leder K, Forbes A, et al. Impact of a large-scale handwashing intervention on reported respiratory illness: findings from a cluster-randomized controlled trial. *Am J Trop Med Hyg.* 2019. doi:10.4269/ajtmh.18-0644
3. Ma Q-X, Shan H, Zhang H-L et al. 2020. Potential utilities of mask-wearing and instant hand hygiene for fighting SARS-CoV-2. *J Med Virol.* doi:10.1002/jmv.25805
4. Dry skin relief from COVID-19 handwashing. AAD.org. https://www.aad.org/public/everyday-care/skin-care-basics/dry/coronavirus-handwashing. Accessed July 25, 2020.
5. Pradhan D, Biswasroy P, Kumar Naik P, et al. A review of current interventions for COVID-19 prevention. *Arch Med Res.* 2020. doi:10.1016/j.arcmed.2020.04.020
6. M, Thibodeau R. Dakin Solution (Sodium Hypochlorite) [Updated 2020 Apr 20]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2020 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK507916/
7. GM Fair, et al. The dynamics of water chlorination. *J N E Water Work Assoc.* 1947;61:285–391.
8. GM Fair, et al. The behaviour of chlorine as a water disinfectant. *J N E Water Work Assoc.* 1948;40:1051–1061.
9. Aronson JK, ed. Sodium hypochlorite and hypochlorous acid. In: *Meyler's Side Effects of Drugs (Sixteenth Edition).* Elsevier; 2016:418-420.
10. Hon KL, Tsang YC, Lee VW, et al. Efficacy of sodium hypochlorite (bleach) baths to reduce Staphylococcus aureus colonization in childhood onset moderate-to-severe eczema: A randomized, placebo-controlled cross-over trial. *J Dermatolog Treat.* 2016; 27(2):156-162. doi:10.3109/09546634.2015.1067669.
11. Majewski S, Bhattacharya T, Asztalos M, et al. Sodium hypochlorite body wash in the management of Staphylococcus aureus-colonized moderate-to-severe atopic dermatitis in infants, children, and adolescents. *Pediatr Dermatol.* 2019; 36(4):442-447. doi:10.1111/pde.13842.
12. When and how to wash your hands. Cdc.gov. https://www.cdc.gov/handwashing/when-how-handwashing.html. Published July 17, 2020. Accessed July 25, 2020.
13. Biosciences Laboratories Final Report # 2003161-402, June 24, 2010, TopMD Data on File.
14. Gebel J, Exner M, French G, et al. The role of surface disinfection in infection prevention. *GMS Hyg Infect Control.* 2013;8(1):Doc10. Published 2013 Apr 29. doi: 10.3205/dgkh000210.
15. International chemical safety cards. https://www.ilo.org/dyn/icsc/showcard.listCards3. Accessed July 31, 2020.

AUTHOR CORRESPONDENCE

Brian Berman MD PhD
E-mail:..... bbmdphd@gmail.com