Hand Hygiene and Hand Care
A Peer-Reviewed Publication
Written by Eve Cuny RDA, MS

Abstract
Hand hygiene is important for the protection of patients and healthcare workers, and the Centers for Disease Control and Prevention issued recommendations in 2003 that specifically includes guidelines for hand hygiene in dental settings. Several options exist for hand hygiene prior to nonsurgical dental procedures, and the selected method may vary according to the level of contamination, the desired antimicrobial activity and the type of procedure. The most significant difference between hand hygiene for routine procedures and for surgical procedures is the need for persistent antimicrobial activity in products used for surgical hand antisepsis. Appropriate selection of products as well as appropriate hand care helps prevent adverse effects related to hand hygiene in the dental setting. Selecting the products that suit the types of procedures performed in a given practice, and the needs of the healthcare personnel in that practice are important considerations. It is likely that a combination of soap, alcohol-based hand sanitizer, and lotions will be required to meet the needs of all individuals.

Educational Objectives
At the conclusion of this educational activity participants will be able to:
1. Describe the structure of skin.
2. List and describe hand hygiene for medical and surgical procedures.
3. List and describe the potential adverse effects of repeated hand hygiene and methods to avoid and counteract these.
4. List and describe the considerations involved in choosing products for hand hygiene and hand care.

Author Profile
Eve Cuny RDA, MS, is the Director of Environmental Health and Safety and Assistant Professor in the Department of Pathology and Medicine at the University of the Pacific School of Dentistry. She has consulted with the Centers for Disease Control and Prevention, American Dental Association, California OSHA, California Dental Board and other agencies on issues related to safety and infection control in dentistry. She has presented over 100 continuing education programs throughout the world and published numerous articles and textbooks.

Author Disclosure
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Hand hygiene is important for the protection of patients and healthcare workers, and the Centers for Disease Control and Prevention issued recommendations in 2003 that specifically includes guidelines for hand hygiene in dental settings. Several options exist for hand hygiene prior to nonsurgical dental procedures, and the selected method may vary according to the level of contamination, the desired antimicrobial activity and the type of procedure. The most significant difference between hand hygiene for routine procedures and for surgical procedures is the need for persistent antimicrobial activity in products used for surgical hand antisepsis. Appropriate selection of products as well as appropriate hand care helps prevent adverse effects related to hand hygiene in the dental setting. Selecting the products that suit the types of procedures performed in a given practice, and the needs of the healthcare personnel in that practice are important considerations. It is likely that a combination of soap, alcohol-based hand sanitizers and lotions will be required to meet the needs of all individuals.

Introduction
The importance of hand hygiene for the protection of patients and healthcare workers has been well-documented in acute care settings. Healthcare-acquired infections are a major source of illness and death in hospitalized patients, and approximately 20%-40% of these infections are a result of cross-infection via the hands of healthcare personnel (HCP). Studies show that contamination of the hands of HCP often occurs as a result of contact with contaminated environmental surfaces. While environmental decontamination remains an important aspect of infection control, hand hygiene is the most important method for reducing the risk of cross-contamination from HCP to patient. In addition, HCP are at risk for self-contamination via their hands when they do not perform hand hygiene after patient contact and contact with the patient care environment. Whether in an acute care setting such as a hospital or an outpatient care setting such as in a dental office, hand hygiene is a vital element of an effective infection control program.

Hand hygiene is the most important method for reducing the risk of cross-contamination from HCP to patient.

For the purposes of understanding the role of hands in disease transmission, the organisms that reside on the hands of any person can be divided into two broad categories: transient and resident flora. Transient organisms are picked up as a person touches surfaces and materials in the environment. Any surface exposed to the environment will contain microorganisms, and surfaces that have been touched during patient care or that contain body fluids are at risk of contamination with pathogenic organisms that can be carried on hands that have come into contact with that surface or material. Transient organisms reside in the outer layers of a person’s skin and are easily removed using appropriate hand hygiene techniques.

Resident flora are organisms that reside in deeper layers of a person’s skin. Less likely than transient flora to be pathogenic, these organisms are more difficult to remove through hand washing or other hand hygiene activities such as the use of alcohol-based hand sanitizers. The goal of hand hygiene is not to create an environment where no organisms are present on the hands, but to take action to reduce the number of the organisms that are most likely to cause infection: the transient organisms.

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Background
The role of hand hygiene in the prevention of disease transmission is not a new concept, nor is it restricted to healthcare settings. The recent H1N1 influenza pandemic heightened everyone’s awareness of the role of hand contact in disease transmission. In the absence of an effective vaccine, much of the public health campaign to prevent the spread of H1N1 influenza focused on cough etiquette (that is, covering your cough and coughing into a sleeve or tissue instead of the hands) and frequent hand washing or use of hand sanitizers.

Although there had been previous efforts to promote hand hygiene in hospitals, it is believed that Ignaz Semmelweis was the first to institute a hand hygiene program and document the positive effects of that program. Semmelweis was a physician at the General Hospital of Vienna in the mid-1800s. In 1846, Semmelweis noted that the postpartum maternal infection rates among women whose babies were delivered by physicians and medical students were much higher than those among women in the ward where the babies were delivered by midwives. After observing the clinics, Semmelweis determined that the source of infection could be cadaverous material on the hands of the physicians and medical students as they traveled between the autopsy suite and the maternity ward. Although the physicians and students washed with soap and water, there was still a disagreeable odor to their hands upon leaving the autopsy suite. Semmelweis’ theory was that the material left on the hands of the physicians from the autopsies was cross-infecting the mothers. In 1847, Semmelweis instituted a program at the hospital in which the physicians and medical students washed and then disinfected their hands with a chlorinated lime solution as an
antiseptic before examining patients or delivering babies. The maternal mortality rates in the physicians’ clinic plummeted from approximately 10% to less than 2% the first year and remained low for years as the physicians and students continued the hand hygiene protocol.4

Just a few years earlier, in the United States, Oliver Wendell Holmes was arriving at the same theory and wrote a paper in a small New England medical journal on the contagious nature of the often fatal childbed fever some women contracted in maternity wards within days of giving birth. He also implicated the unclean hands of the physicians in the transmissions. This was in contradiction to the prevailing theory of disease transmission at the time, which was that diseases were a result of miasma (bad air) or the balance of humors in a patient’s body, and Holmes was publicly criticized for promoting his theory of contagion. The work of both Semmelweis and Holmes laid the groundwork for modern infection control.

Skin Structure and Function
Human skin provides protection against microorganisms, acts as a permeability barrier to the environment, helps maintain proper body temperature and reduces water loss from the body.5 It is able to function in this way because of the structure of the layers of the skin. From outer- to innermost layer, skin structure includes the outer superficial region, epidermis, dermis and hypodermis (Figure 1). Between and in these layers are additional cells that aid in cohesion, synthesis, pigmentation, immune response and sensory reception.

Epidermis
Within the epidermal layer are cells that are composed of a lipid, which is necessary for the skin to function as a barrier. There is some evidence that repeated use of detergents can result in disruption of the lipid, potentially leading to some loss of barrier function.5 The epidermis contains no vascular network, and the cells within this layer receive their nutrients from passive diffusion from the dermal layer. The epidermis contains Langerhans cells, which are essential to the immune system in the skin, and melanocyte cells, which produce pigment for skin coloration and protection.

Dermis
The dermis contains hair follicles, sweat glands, sebaceous glands, apocrine glands, lymphatic vessels and blood vessels. Dermal tissue comprises elastic tissue, collagen and reticular fibers. The dermis is responsible for skin’s flexibility and strength. The structures within the dermis provide temperature regulation (sweat glands and blood vessels), moisture and barrier protection (sebaceous glands), hair (hair follicles), and regrowth (stem cells).

Hypodermis
The hypodermis is primarily composed of connective tissue and adipocytes, which are cells that accumulate and store fats. The adipocytes are grouped together in lobules of fatty tissue. The hypodermis (sometimes called subcutaneous tissue) attaches skin to the deeper layers of fascia and contains hair follicle roots, larger blood vessels and nerves in addition to the connective tissue and fat. The hypodermis fastens the skin to the underlying surface, provides thermal insulation and absorbs shocks from impacts to the skin.

Figure 1. The structure of skin

Recommendations
The Centers for Disease Control and Prevention (CDC) issued a set of recommendations for hand hygiene in all healthcare settings in 2002.5 In addition, the CDC included specific guidelines for hand hygiene in dental settings in the 2003 recommendations specific to infection control in dentistry.6

Prior to hand hygiene procedures
Before undertaking hand hygiene procedures, it is necessary to consider factors that may inhibit the effectiveness of the process. Although it is unknown whether rings on the hands of HCP increase the risk of disease transmission, some studies have shown that the skin underneath rings is more heavily colonized for certain types of bacteria compared to skin without rings.7,8 Due to this theoretical potential for rings to increase the risk of hand contamination even after hand hygiene, the CDC recommends that dental healthcare personnel (DHCP) not wear hand or nail jewelry if it makes donning gloves more difficult or compromises the fit and integrity of medical gloves.6

Fingernail length and artificial nails may also interfere with effective hand washing and may be responsible for increased microbial contamination of the hands of HCP. Since the majority of flora on the hands are found under and around the fingernails, keeping nails short is recommended.5,6 Flora trapped under artificial nails have been implicated in infectious outbreaks in
patient care settings. In addition, colonization of artificial nails increases with the length of time the nails are worn. The CDC makes a strong recommendation against wearing artificial nails or nail extenders when having contact with patients at high risk of infection, such as those in intensive care or the operating room. It is recommended that artificial nails should not be worn in patient care settings.

Routine procedures
Several options exist for hand hygiene prior to nonsurgical dental procedures. Selection of the method for hand hygiene varies according to the level of contamination, the desired antimicrobial activity and the type of procedure (Table 1). It is acceptable to use plain or antimicrobial soap and water before donning and after removing gloves. If hands are not soiled and have no visible debris, an alcohol-based hand sanitizer is also an acceptable option.

When using soap and water, hands should be washed for a full 15 seconds and all surfaces of premoistened lathered hands should be rubbed together vigorously to remove debris and transient organisms. Washing should be followed by rinsing under a stream of cool or tepid water. Before donning gloves, dry hands thoroughly with disposable towels. If alcohol-based hand sanitizers are used, the product should be rubbed on all surfaces of the hands until the product has dried. Refer to the manufacturer's directions for the appropriate amount of solution to use. Effective products will contain between 60% and 95% ethanol or isopropanol as the active ingredient.

There is an indication that ethanol provides better virucidal activity than isopropanol does. In addition, the amount of product can affect its antimicrobial activity. Although the ideal amount of alcohol-based hand rub to use is unknown, it has been demonstrated that 1 mL is less effective than 3 mL when applied to hands. It is not necessary to wash hands and also use an alcohol-based hand rub for routine dental procedures. In fact, there is some evidence that doing so will result in an increased risk of dermatitis.

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Surgical procedures
The most significant difference between hand hygiene for routine procedures and for surgical procedures is the need for persistent antimicrobial activity in products used for hand antisepsis. Many of the antimicrobial hand soaps contain chemicals with persistent activity, such as chlorhexidine, iodine, iodophors, phenol derivatives, triclosan or quaternary ammonium compounds (Table 2). Alcohol-based hand rubs do not have persistent activity unless one of these other chemical agents has been added to the formulation.

The CDC guidelines offer two options for hand hygiene prior to surgical procedures. The first is to scrub the hands with an antimicrobial soap with persistent activity for the time indicated by the manufacturer, usually 2-6 minutes. The second alternative is to wash hands with plain soap and water, followed by application of an alcohol-based hand rub with persistent activity (Table 1). The intent of the extended time for hand washing is to remove the majority of transient flora in addition to some of the resident flora from the DHCP hands. Persistent activity is necessary to prevent contamination of the surgical site by flora on the DHCP hands if the gloves are accidentally torn or punctured during the procedure.

The most significant difference between hand hygiene for routine procedures and for surgical procedures is the need for persistent antimicrobial activity in products used for surgical hand antisepsis.

In selecting an antimicrobial soap, it is important to understand the antimicrobial spectrum and characteristics of the antiseptic agent, including persistent activity. In addition, some agents are substantially affected by organic material on the hands (e.g., blood) or other agents, while others are not. Chlorhexidine gluconate is only minimally affected by the presence of organic material, but its activity is reduced by the presence of natural soaps, hand creams containing anionic emulsifying agents, various inorganic anions and nonionic surfactants. In contrast, in the presence of organic substances, the antimicrobial activity of iodophors is substantially reduced. Within the quaternary ammonium compounds agents, the most commonly used are the alkyl benzalko-
nium chlorides; others include benzethonium chloride, cetrimide, and cetylpyridium chloride. The kill achieved using quaternary ammonium compounds is adversely affected by the presence of organic material. Triclosan has antimicrobial activity at a concentration of 0.2%-2.0% and has persistent activity. Although its activity is affected by pH, the presence of surfactants, emollients and humectants, it is not substantially affected by organic matter.

Potential adverse effects of hand hygiene
The need to perform frequent hand hygiene does not come without potential adverse effects. Frequent hand washing with some detergents and alcohols depletes the surface lipids of the skin, resulting in dryness. Over time, irritant contact dermatitis or allergic contact dermatitis can result from frequent use of hand hygiene products, particularly soaps and detergents.

### Irritant contact dermatitis
Symptoms of irritant contact dermatitis include dryness, irritation, itching, cracking and bleeding. Some of the antiseptic agents that may cause irritant contact dermatitis include iodophors (most common), chlorhexidine, chloroxylenol, triclosan and alcohol-based products. The addition of emollients and humectants to hand hygiene products can reduce their potential for causing irritant contact dermatitis. These additives help smooth and soften the skin or aid in maintaining hydration of the skin. One large study found that when HCP used an alcohol-based hand rub that contained emollients and chlorhexidine gluconate, they experienced a very low rate of adverse reactions in the skin of their hands. Alcohol-based products have a lower tendency for causing contact dermatitis than many of the other disinfectant or detergent-based products. If a burning sensation is experienced...

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### Table 1. Hand-hygiene methods and indications

<table>
<thead>
<tr>
<th>Method</th>
<th>Agent</th>
<th>Purpose</th>
<th>Duration (minimum)</th>
<th>Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Routine hand wash</td>
<td>Water and nonantimicrobial soap (e.g., plain soap+)</td>
<td>Remove soil and transient microorganisms</td>
<td>15 seconds§</td>
<td>Before and after treating each patient (e.g., before glove placement and after glove removal). After barehanded touching of inanimate objects likely to be contaminated by blood or saliva. Before leaving the dental laboratory. When visibly soiled.§ Before regloving after removing gloves that are torn, cut, or punctured</td>
</tr>
<tr>
<td>Antiseptic hand wash</td>
<td>Water and antimicrobial soap (e.g., chlorhexidine, iodine and iodophors, chloroxylenol [PCMX], triclosan)</td>
<td>Remove or destroy transient microorganisms and reduce resident flora</td>
<td>15 seconds§</td>
<td>Same as above</td>
</tr>
<tr>
<td>Antiseptic hand rub</td>
<td>Alcohol-based hand rub¶</td>
<td>Remove or destroy transient microorganisms and reduce resident flora</td>
<td>Rub hands until the agent is dry¶</td>
<td>Same as above</td>
</tr>
<tr>
<td>Surgical antisepsis</td>
<td>Water and antimicrobial soap (e.g., chlorhexidine, iodine and iodophors, chloroxylenol[PCMX], triclosan)</td>
<td>Remove or destroy transient microorganisms, and reduce resident flora (persistent effect)</td>
<td>2-6 minutes</td>
<td>Before donning sterile surgeon’s gloves for surgical procedures++</td>
</tr>
<tr>
<td>Surgical antisepsis (al-</td>
<td>Water and non-antimicrobial soap (e.g., plain soap+) followed by an alcohol-based surgical hand-scrub product with persistent activity</td>
<td>Same as above</td>
<td>Follow manufacturer’s instructions for surgical hand-scrub product with persistent activity¶*</td>
<td>Same as above</td>
</tr>
<tr>
<td>ternative method)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


+Pathogenic organisms have been found on or around bar soap during and after use. Use of liquid soap with hands-free dispensing controls is preferable.

§Time reported as effective in removing most transient flora from the skin. For most procedures, a vigorous rubbing together of all surfaces of premoistened lathered hands and fingers for ≥ 15 seconds, followed by rinsing under a stream of cool or tepid water, is recommended. Hands should always be dried thoroughly before donning gloves.

¶Alcohol-based hand rubs should contain 60%-95% ethanol or isopropanol and should not be used in the presence of visible soil or organic material. If using an alcohol-based hand rub, apply adequate amount to palm of one hand and rub hands together, covering all surfaces of the hands and fingers, until hands are dry. Follow manufacturer’s recommendations regarding the volume of product to use. If hands feel dry after rubbing them together for 10-15 seconds, an insufficient volume of product likely was applied. The drying effect of alcohol can be reduced or eliminated by adding 1%-3% glycerol or other skin-conditioning agents.

*After application of alcohol-based surgical hand-scrub product with persistent activity as recommended, allow hands and forearms to dry thoroughly and immediately don sterile surgeon’s gloves. Follow manufacturer’s instructions.

++Before beginning surgical hand scrub, remove all arm jewelry and any hand jewelry that may make donning gloves more difficult, cause gloves to tear more readily or interfere with glove usage (e.g., ability to wear the correct-sized glove or altered glove integrity).
when using alcohol-based products, it is an indication that the skin barrier has previously been broken and not an indication that use of the alcohol-based product is resulting in skin irritation.17

Repeated use of detergents can result in disruption of the lipid, potentially leading to some loss of barrier function.

Allergic contact dermatitis
Allergic reactions may occur as a result of exposure to products applied to the skin. The most common causes of allergic reaction are fragrances and preservatives in products. These are potentially found in liquid soaps, hand lotions, ointments or creams.13 Allergic reactions have been reported in connection with antiseptic agents used in some antimicrobial hand soaps. The ingredients associated with allergic reactions include quaternary ammonium compounds, iodine or iodophors, chlorhexidine, triclosan, chloroxylenol, and, rarely, alcohols. Some antiseptic agents are more commonly associated with skin irritations and allergic reactions than others – iodophors cause fewer allergic reactions and less skin irritation than iodine but more irritant contact dermatitis than other antiseptics commonly used for hand hygiene. The irritant effect of several antiseptic agents, including free iodine, triclosan and chlorhexidine gluconate, is also concentration dependent. Allergic reactions to triclosan and chlorhexidine gluconate are rare.

Respiratory allergies
Respiratory allergies may also occur with the use of hand hygiene products containing strong fragrances. When selecting hand hygiene products, it is important to ensure that the product will not result in respiratory allergies, other allergic reactions or skin irritation in any HCP in the office, to prevent health problems and – in the case of skin irritation – to aid compliance with hand hygiene procedures.

Reducing Irritation
DHCP can employ several strategies to reduce hand irritation due to hand hygiene procedures. Since soaps and detergents tend to be more irritating to the skin than alcohol-based products, using alcohol hand rubs with emollients instead of soap and water when indicated has been shown to help prevent drying and irritation.15 Donning gloves while hands are still wet also increases skin irritation. DHCP should dry hands thoroughly before donning gloves and, when possible, use alcohol-based hand rubs and allow the product to evaporate completely before putting on gloves.

Table 2. Antimicrobial Spectrum and Characteristics of Hand-Hygiene Antiseptic Agents*

<table>
<thead>
<tr>
<th>Group</th>
<th>Gram-positive bacteria</th>
<th>Gram-negative bacteria</th>
<th>Mycobacteria</th>
<th>Fungi</th>
<th>Viruses</th>
<th>Speed of action</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohols</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>Fast</td>
<td>Optimum concentration 60%-95%; no persistent activity</td>
</tr>
<tr>
<td>Chlorhexidine (2%-4% aqueous)</td>
<td>+++</td>
<td>++</td>
<td>+</td>
<td>+</td>
<td>+++</td>
<td>Intermediate</td>
<td>Persistent activity; rare allergic reactions</td>
</tr>
<tr>
<td>Iodine compounds</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>++</td>
<td>+++</td>
<td>Intermediate</td>
<td>Cause skin burns; usually too irritating for hand hygiene</td>
</tr>
<tr>
<td>Iodophors</td>
<td>+++</td>
<td>+++</td>
<td>+</td>
<td>++</td>
<td>++</td>
<td>Intermediate</td>
<td>Less irritating than iodine; acceptance varies</td>
</tr>
<tr>
<td>Phenol derivatives</td>
<td>+++</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>Intermediate</td>
<td>Activity neutralized by nonionic surfactants</td>
</tr>
<tr>
<td>Triclosan</td>
<td>+++</td>
<td>++</td>
<td>+</td>
<td>-</td>
<td>+++</td>
<td>Intermediate</td>
<td>Acceptability on hands varies</td>
</tr>
<tr>
<td>Quaternary ammonium compounds</td>
<td>+</td>
<td>++</td>
<td>_</td>
<td>_</td>
<td>_</td>
<td>Slow</td>
<td>Used only in combination with alcohols; ecological concerns</td>
</tr>
</tbody>
</table>


Note: +++ = excellent; ++ = good, but does not include the entire bacterial spectrum; + = fair; - = no activity or not sufficient.

*Hexachlorophene is not included because it is no longer an accepted ingredient of hand disinfectants.
Table 3. Tips for Reducing Skin Irritation

<table>
<thead>
<tr>
<th>Tip</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use alcohol-based hand rubs with emollients when appropriate</td>
</tr>
<tr>
<td>Dry hands thoroughly before donning gloves</td>
</tr>
<tr>
<td>Allow alcohol-based hand rubs to evaporate completely before putting on gloves</td>
</tr>
<tr>
<td>Use hand lotion at least twice a day</td>
</tr>
<tr>
<td>Use medical-grade creams</td>
</tr>
<tr>
<td>Select nonallergenic products</td>
</tr>
</tbody>
</table>

Hand Care

Hand lotions, creams and other skin moisturizers can increase skin hydration and replace the depleted skin lipids. This will help the skin maintain its barrier function. Using hand lotion twice a day can prevent and treat irritant contact dermatitis caused by the use of hand hygiene products. A side benefit to improved skin condition appears to be increased compliance with hand hygiene protocols, as individuals are more reluctant to wash their hands frequently if they perceive that it causes excessive dryness of their skin. Barrier creams are often offered to DHCP as a solution for hand hygiene-associated dermatitis. These products are intended to form a protective layer over the skin and reduce the irritation associated with frequent use of hand hygiene products. According to the CDC hand hygiene guidelines, these products do not appear to yield better results than the use of lotions. Medical-grade repair creams are also available, intended to prevent excessive transepidermal water loss. One study assessed a repair cream containing dimethicone (1.5%) and its effect on skin erythema and dryness in healthcare workers in an intensive care unit. It was found that 5 to 10 daily applications of either cream per day for 2 weeks resulted in reduced knuckle dryness compared to normal skin care. In addition, the least erythema was observed with the repair cream containing dimethicone. When selecting hand lotions, creams and moisturizers, it is advisable to select a medical-grade product to ensure that it is compatible with recommended hand hygiene procedures and in particular with gloving protocols and the type of glove (material) being used, as well as effective. Creams, moisturizers and lotions should be latex-friendly, nonallergenic, compatible with antiseptic agents, nongreasy and preferably fragrance-free to avoid allergies (or personal adverse selection).

When selecting hand lotions, creams and moisturizers, it is advisable to select a medical-grade product to ensure that it is compatible with recommended hand hygiene procedures.

Summary

Hand hygiene procedures are necessary before treating each patient, when removing gloves after patient care, and any time hands may have come into contact with body fluids through touching contaminated surfaces or patient care equipment. Selecting the products that suit the types of procedures performed in a given practice and the needs of the HCP in that practice are important considerations. It is likely that a combination of soap, alcohol-based hand sanitizer and lotions will be required to meet the needs of all individuals.

Healthcare personnel should receive training in proper hand hygiene – including when it is appropriate to use alcohol-based hand sanitizers and when surgical hand hygiene must be performed. Adherence to hand hygiene recommendations is a challenge in all healthcare settings, and ensuring that HCP understand the role of hands in the spread of healthcare-associated infections.
and the types of activities that can result in hand contamination are key components of a training program. Role modeling of good hand hygiene practices by leadership in the practice, including dentists and senior allied health professionals, may be a useful tool in increasing compliance.

It is essential to keep abreast of hand hygiene recommendations. Continued studies are evaluating the safety of the various products, including whether some hand hygiene agents are implicated in antimicrobial resistance. As the science and knowledge advance, it may be necessary to make adjustments to the dental practice hand hygiene protocol.

References
12 Ibid.

Author Profile
Eve Cuny RDA, MS
Eve Cuny is the Director of Environmental Health and Safety and Assistant Professor in the Department of Pathology and Medicine at the University of the Pacific School of Dentistry. She has consulted with the Centers for Disease Control and Prevention, American Dental Association, California OSHA, California Dental Board and other agencies on issues related to safety and infection control in dentistry. She has presented over 100 continuing education programs throughout the world and published numerous articles and textbooks.

Author Disclosure
Eve Cuny RDA, MS has no commercial ties with the sponsors or the providers of the unrestricted educational grant for this course. Ms. Cuny is also founder and managing partner of Eve Cuny Consultants, LLC, a consulting group specializing in product evaluation, professional writing and other services to the dental profession and industry.
Questions

1. Which of the following is correct regarding the categories of organisms that reside on the hands?
   a. Transient and resident flora
   b. Transitory and resident flora
   c. Transitory and resident flora
   d. Transient and resident flora

2. The goal of hand hygiene is to:
   a. Create an environment where no organisms are present
   b. Take action to reduce the number of the organisms that are most likely to cause infection
   c. Create an environment where only transient flora is present
   d. None of the above

3. Which of the following is credited with instituting a hand hygiene program?
   a. Ignaz Bevelweis
   b. Ignaz Harmelweis
   c. Ignaz Semmelweis
   d. Ignaz Zwemmelweis

4. Human skin:
   a. Provides protection against microorganisms
   b. Helps maintain proper body temperature and reduces water loss from the body
   c. Acts as a permeability barrier
   d. All of the above

5. Skin structures include the:
   a. Dermis
   b. Epidermis
   c. Hypodermis
   d. All of the above

6. The CDC included specific guidelines for hand hygiene in dental settings in the recommenda-
   tions made in:
   a. 2002
   b. 2003
   c. 2004
   d. 2005

7. Which of the following may interfere with effective hand washing?
   a. Long fingernails
   b. Artificial nails
   c. Hand jewelry
   d. All of the above

8. Prior to nonsurgical dental procedures, if hands are not soiled, which of the following is an acceptable option?
   a. Ether-based hand sanitizer
   b. Alcohol-based hand sanitizer
   c. Alcohol-based hand soap
   d. b and c

9. When using soap and water, hands should be washed for a full:
   a. 5 seconds
   b. 10 seconds
   c. 15 seconds
   d. 20 seconds

10. Before donning gloves, hands should be dried thoroughly with:
    a. Disposable towels
    b. An air jet
    c. Reusable towels
    d. a or c

11. Persistent antimicrobial activity is necessary to prevent contamination of the surgical site by flora on the DHCP hands if:
    a. He or she elects not to wear gloves despite guidelines and recommendations
    b. He or she elects to reuse gloves despite guidelines and recommendations
    c. The gloves are accidentally torn or punctured during the procedure
    d. All of the above

12. Which of the following substantially reduces the antimicrobial activity of iodophors?
    a. Soap
    b. Alcohol
    c. Organic substances
    d. All of the above

13. The activity of triclosan is affected by:
    a. pH
    b. Surfactants
    c. Emollients and surfactants
    d. All of the above

14. Over time, frequent use of hand hygiene products can result in:
    a. Asthma
    b. Irritant contact dermatitis
    c. Allergic contact dermatitis
    d. b and c

15. Which of the following is a symptom of irritant contact dermatitis?
    a. Dryness
    b. Irritation and itching
    c. Cracking and bleeding
    d. All of the above

16. Which of the following causes more irritant contact dermatitis than other antiseptics commonly used for hand hygiene?
    a. Triclosan
    b. Quaternary ammonium compounds
    c. Iodophors
    d. All of the above

17. Which of the following helps to remove skin irritation?
    a. Using hand lotion at least twice a day
    b. Donning gloves when hands are thoroughly dry
    c. When appropriate, using an alcohol-based hand rub containing emollients
    d. All of the above

18. Using a hand lotion:
    a. Can prevent and treat irritant contact dermatitis
    b. Appears to increase compliance with hand hygiene protocols
    c. Helps the skin maintain its barrier function
    d. All of the above

19. One study on the use of a repair cream containing dimethicone (1.5%) found that it:
    a. Reduced knuckle dryness
    b. Resulted in less erythema being observed
    c. Increased lipid loss
    d. a and b

20. When selecting hand lotions, creams and moisturizers, it is advisable to select a medical-grade product to ensure that:
    a. It is compatible with recommended gloving protocols
    b. It is compatible with the type of glove being used
    c. You go through the proper channels
    d. a and b
Learning Objectives

1. Describe the structure of skin.
2. List and describe hand hygiene for medical and surgical procedures.
3. List and describe the goals of complete denture fabrication
4. List and describe the potential adverse effects of repeated hand hygiene and methods to avoid and counteract these.
5. List and describe the considerations involved in choosing products for hand hygiene and hand care.

Course Evaluation

Please evaluate this course by responding to the following statements, using a scale of Excellent = 5 to Poor = 0.

1. Were the individual course objectives met?
   - Objective #1: Yes No
   - Objective #2: Yes No
   - Objective #3: Yes No

2. To what extent were the course objectives accomplished overall?
   - 5 4 3 2 1 0

3. Please rate your personal mastery of the course objectives.
   - 5 4 3 2 1 0

4. How do you rate the author's grasp of the topic?
   - 5 4 3 2 1 0

5. How do you rate the instructor's effectiveness?
   - 5 4 3 2 1 0

6. Please rate the author's grasp of the topic?
   - 5 4 3 2 1 0

7. Was the overall administration of the course effective?
   - 5 4 3 2 1 0

8. Was the overall administration of the course effective?
   - 5 4 3 2 1 0

9. Do you feel that the references were adequate? Yes No

10. If any of the continuing education questions were unclear or ambiguous, please list them.

11. Was there any subject matter you found confusing? Please describe.

12. What additional continuing dental education topics would you like to see?

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