Factors to Consider When Selecting Skin Cleansing Products

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The number of commercially marketed skin cleansing agents continues to grow, providing clinicians with an increasingly large variety of products from which to choose. This variety may lead to confusion about which product to choose, particularly for persons without expertise in the area of skin care. This article reviews common types of skin cleansers, their formulation, ingredients, skin compatibility, pH, and related infection control issues. (J WOCN 2000;27:260-8)

WOC nurses highly value skin integrity, and much of our practice is dedicated to the prevention of skin breakdown and the treatment of persons with altered skin integrity. WOC nursing practice incorporates detailed knowledge of the characteristics of wound and skin care products; however, often it is persons with less expertise in skin care who select the products that many health care facilities use for skin cleansing. Whether a skin cleanser is intended for routine hand washing or general bathing, an understanding of the various formulations and ingredients of cleansers is essential for appropriate product selection. These considerations affect compliance with handwashing policies, nosocomial infection rates, and the integrity of the skin of all persons using the cleanser. This article reviews the formulations of commonly used skin cleansers and provides implications for their use in clinical practice.

BARRIER FUNCTION OF NORMAL SKIN

The healthy epidermis provides an effective barrier against noxious agents and infectious organisms. Normal skin provides a barrier that can be analogized to “brick and mortar” with the epithelial cells acting as bricks and the skin lipids as mortar. Any substance that comes into contact with the skin and strips away its lipids produces a defect within this barrier. Such defects may permit invasion by pathogens or environmental irritants. The integrity of the skin’s barrier function is typically measured by its transepidermal water loss (TEWL). TEWL is the evaluation of changes in the rate of passive evaporation (moisture loss) through the skin. Normal TEWL varies according to the area of the body. TEWL values rise as the barrier function declines as the skin becomes dryer, with less water content. A decrease in TEWL values can be related to an improvement in the ability of the skin to act as a barrier against moisture loss.

The typical or normal bacterial flora that inhabits the skin is related to its barrier function. Species of bacteria normally found on human skin actually provide bacterial interference against the overgrowth of pathogenic microorganisms. Examples of species normally found on human skin include Staphylococcus, Micrococcus, Neisseria, Peptococcus, Corynebacterium, Propionibacterium, Streptococcus, and Acinetobacter. Not all species are found on one person, but most people carry at least 5 of these species as normal bacterial flora.

The ideal skin cleanser removes unwanted microorganisms while maintaining the skin’s barrier function. The characteristics of the ideal skin cleanser will vary according to the needs of those using the product. For example, a nurse with frequent exposure to contaminants will require a different product for hand washing when compared with an elderly resident of a long-term care facility using a cleanser for general body bathing. Therefore, product selection decisions primarily should be based on identification of intended users, clinical goals, and an
understanding of ingredients and formulation concepts.

**SOAP VERSUS DETERGENT**

I have observed that many clinicians make incorrect assumptions about cleansing agents. For example, the terms “soap” and “detergent” are commonly used interchangeably. Despite important differences in these terms, they are often used as generic words indicating any cleansing product, including a laundry detergent or a hand soap. A detergent is a cleansing or purging surfactant. In contrast, a soap is a natural surfactant made of sodium or potassium salts. Detergents are often mistakenly perceived as harsh compared with soap. In reality, the term “detergent” encompasses both soaps and synthetic detergents; the synthetic detergents usually represent milder alternatives to soaps. All detergents contain some form of surfactant. Surfactants are chemical substances that adhere to the skin and induce changes that facilitate the removal of dirt and debris from the skin surface.

Soaps, which were developed as early as 1780, are made of alkali salts of fatty acids and can be formulated as a liquid or solid bar. Synthetic detergents were developed in the late 1940s and early 1950s as a milder alternative to soaps; these products are also manufactured in liquid or bar form. Contrary to popular myth, a liquid formulation does not necessarily mean that the product is nonirritating. Both natural soaps and synthetic detergents are manufactured as liquids, and the nurse should carefully evaluate the ingredients and formulation when making product decisions. Although a soap is considered a natural detergent, it has disadvantages, including a high pH, poor rinsing properties, and scum residue when rinsed with hard water. These disadvantages led to the development of milder detergents containing synthetic surfactants in the late 1940s and early 1950s. Because of their synthetic surfactants, liquid detergents avoid these disadvantages associated with natural soap. However, many products referred to as soaps are actually synthetic detergents, and it is possible to confuse a gentle liquid cleanser with a relatively harsh liquid soap unless the nurse remains aware of the product’s ingredients and formulation.

In addition to differentiating soaps versus detergents, the nurse should identify key ingredients when selecting a product for routine skin cleansing (Box). For example, persons with allergies may be harmed when using a cleansing product that contains one or more ingredients likely to produce a hypersensitive reaction. An understanding of the function of each ingredient also helps the nurse achieve the intended outcome. For example, if a cleanser is needed that reduces pathogenic organisms on the skin, a product with antimicrobial properties is selected.

In addition to considerations of specific ingredients, it is essential to understand the total formulation and the combined effect of individual ingredients. For example, a highly effective cleanser (surfactant) may achieve the goals of moving soil and reducing bacteria counts, but it also tends to strip away lipids and compromise cutaneous barrier function. However, instead of selecting a less effective cleanser, the nurse may be able to combine the cleanser with a compatible moisturizer/conditioning product that restores the lipid content of the skin.

**KEY INGREDIENTS**

**Surfactants**

Surfactants (also known as surface acting agents) are chemical substances that adhere to skin surfaces and decrease the amount of friction required to remove unwanted materials (Table 1). Surfactants are incorporated into cleansing agents because the dirt that collects within the lipids of the skin is not effectively removed by water alone, even with reasonably vigorous mechanical washing. The area of the surfactant molecule that provides the greatest detergent effect is its hydrophilic or polar region. Surfactants are generally categorized into 4 major groups based on their net charge. Anionic surfactants have a net negative charge, cationic surfactants have a net positive charge, amphoteric surfactants have both positive and negative charges, and nonionic surfactants carry no electrical charge.

Anionic surfactants include the natural soap surfactants (eg, potassium cocoate) and specific synthetic surfactants including sodium lauryl sulfate (SLS), triethanolamine lauryl sulfate, ammonium lauryl sulfate, and sodium stearate. Surfactants such as SLS are also found in ointments and creams as well as in cleansers. When
incorporated in ointments and creams, the surfactant is used to keep the oil and the water from separating. In addition, when applied to the skin, the surfactant helps lift dirt and oil.1,12,13

SLS is also commonly used as a “gold standard” when demonstrating the irritating potential of detergent products. A one-time occlusive test is typically used for such comparisons. In this design, a substance is placed in contact with the skin under an occlusive dressing for a given time period (usually 24 hours). More recently, some researchers have criticized this method as limited because it fails to adequately replicate the effects of cumulative use in clinical situations.14,15

Cationic surfactants such as cetrimide and benzalkonium play only a minor role in routine skin cleansers because of their incompatibility with anionic surfactants.1,3,14 Cationic surfactants are reported to be less irritating than anionic surfactants, and they have some disinfect properties. Because of these limitations, cationic surfactants are typically used as preservatives based on their bactericidal activity. For example, benzalkonium is widely used as a preservative for ophthalmic products.

Amphoteric surfactants such as cocamidopropylbetaine combine anionic detergent properties with cationic disinfectant properties with cationic disinfectant properties. Activation of the surfactant relies on the pH of the media used; most amphoteric products have a pH of 7 or higher. Amphoteric surfactants are often found in baby products because of their reputation for avoiding irritation of the eye. Nevertheless, a pH higher than 7 can disrupt skin barrier function.1,12,13

Nonionic surfactants include polysorbate 20 and 60. Nonionic surfactants are compatible with all other types of surfactants. Pharmaceutical systems use nonionic surfactants because they are minimally affected by pH. They also have a low toxicity potential and are often used in cosmetic and food products. Nonionic surfactants are used for emulsifying, foam boosting, and solubilizing (dissolution of a substance within a solvent solution).1,12,13

Antimicrobials

Some cleansers combine an antimicrobial and surfactant to reduce bacterial colonization. Commonly used antimicrobials include triclosan, chlorhexidine gluconate (CHG), and para chloroxylenol (PCMX). Products with CHG and PCMX are often used in health care facilities. For example, Hibiclens (ICA Americas, Inc, Wilmington, Del) contains 4% CHG, and Sween
Soft Touch (Coloplast Corp, North Mankato, Minn) contains PCMX. Triclosan is also frequently used in skin cleansing products for health care settings and commercial use. Examples of the many products containing triclosan in a health care setting include Provon Medicated Lotion Soap and Gentle Rain All Body Cleanser by Coloplast Corp. Commercial products containing troclosene include Dial liquid soap (The Dial Corporation, Scottsdale, Ariz) and Softsoap Gentle Antibacterial Body Wash (Colgate-Palmolive Company, New York, NY).

The addition of an antimicrobial agent for skin cleansing remains controversial. Some researchers suggest that the use of antimicrobial-based skin cleansers may be beneficial when managing patients who are colonized with methicillin-resistant *Staphylococcus aureus* (MRSA). However, others contend that little convincing evidence exists that routine use of an antimicrobial cleanser is effective or necessary. These researchers also raise concerns that regular use of an antimicrobial cleanser may increase the risk of selecting for organisms that are resistant to the agents used.

The area of greatest agreement regarding use of an antimicrobial agent occurs in the context of hand washing among health care personnel. Several studies have compared the benefits of antimicrobial cleansers in hand washing among health care personnel with cleansers without an antimicrobials ingredient.

Based on data from these studies, an antimicrobial cleanser is recommended for health care providers with a high frequency of hand washing (8 or more times per day). This advantage disappears among persons with relatively low hand-washing frequency (6 times or less per day).

Current guidelines promulgated by the Association for Professionals in Infection

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**Table 1. Common ingredients***

<table>
<thead>
<tr>
<th>Product</th>
<th>Ingredient</th>
<th>Common uses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Surfactants</strong></td>
<td></td>
<td></td>
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<tr>
<td>Anionic—natural</td>
<td>“Natural soap”</td>
<td>Skin cleansing</td>
</tr>
<tr>
<td></td>
<td>Potassium cocoate</td>
<td></td>
</tr>
<tr>
<td>Anionic—synthetic</td>
<td>Sodium lauryl sulfate</td>
<td>Ointments, creams</td>
</tr>
<tr>
<td></td>
<td>Triethanolamine lauryl sulfate</td>
<td>Skin cleansing</td>
</tr>
<tr>
<td></td>
<td>Ammonium lauryl sulfate</td>
<td>Toothpaste</td>
</tr>
<tr>
<td><strong>Cationic</strong></td>
<td>Citric acid</td>
<td>Disinfectants</td>
</tr>
<tr>
<td></td>
<td>Benzalkonium chloride</td>
<td>Antimicrobial Preservatives</td>
</tr>
<tr>
<td><strong>Amphoteric</strong></td>
<td>Cocamidopropylbetaine</td>
<td>Baby shampoos</td>
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<tr>
<td></td>
<td></td>
<td>Foam boosters</td>
</tr>
<tr>
<td><strong>Nonionic</strong></td>
<td>Polysorbate 20</td>
<td>Shampoo/cosmetic</td>
</tr>
<tr>
<td></td>
<td>Polysorbate 60</td>
<td>Food products</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Laundry/dishwashing</td>
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<tr>
<td></td>
<td></td>
<td>Pharmaceuticals</td>
</tr>
<tr>
<td><strong>Antimicrobials</strong></td>
<td>Triclosan</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chlorhexidine gluconate</td>
<td></td>
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<tr>
<td></td>
<td>Para chloroxylenol</td>
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</tr>
<tr>
<td><strong>Humectants/moisturizers</strong></td>
<td>Glycine</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Methyl glucose esters</td>
<td></td>
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<tr>
<td></td>
<td>Lactates</td>
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<tr>
<td></td>
<td>Lanolin derivatives</td>
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</tr>
<tr>
<td></td>
<td>Mineral oil</td>
<td></td>
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<tr>
<td><strong>Alcohols†</strong></td>
<td>Isopropyl alcohol</td>
<td>Antimicrobial Preservatives</td>
</tr>
<tr>
<td></td>
<td>Benzyl alcohol</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cetyl or stearyl alcohol</td>
<td>Emollients, thickeners</td>
</tr>
<tr>
<td></td>
<td></td>
<td>in moisturizers and lubricants</td>
</tr>
</tbody>
</table>

*Specific ingredients are less important than the effects of all the ingredients combined.
†Some alcohols are emollients and are not drying to the skin.
Control state that the choice between antimicrobial and nonantimicrobial cleansers for hand washing should be based on the degree of hand contamination and whether it is important to reduce counts of resident flora on the hands of health care personnel.5

Humectants and moisturizers

Humectants may be added to a skin cleanser because of their moisturizing effects. Examples of humectants include glycerin, methyl glucose esters, lactates, lanolin derivatives, and mineral oil. Humectants play an important role in maintaining and restoring the skin’s barrier function. Frequent cleansing with any soap or detergent can reduce the lipid content of the stratum corneum. As a result, the barrier function of the skin is compromised and its TEWL rises. This depletion leads to dry, chapped hands and, in some instances, eczema.22 To avoid this adverse outcome, a humectant or moisturizer may be added to the skin cleansers to minimize the loss of lipids. Nevertheless, these ingredients only partially compensate for lipid stripping during hand washing, and an additional compatible moisturizing agent (a lotion or cream) should be applied immediately following cleansing.22

Alcohols

The term “alcohol” describes a diverse group of products. Alcohols are available as both solids and liquids and exert varying effects depending on their specific formulation. For example, isopropyl alcohol acts as an antimicrobial agent, whereas benzyl alcohol acts as a preservative. Cetyl or stearyl alcohols serve as emollients and thickening agents when added to moisturizers or lubricants. When used in this context, they safely enhance the total formula of the product and do not dry the skin.23

ADDITIONAL CONSIDERATIONS

Acid-base Balance

Healthy skin is somewhat acidic with a pH of 5.5.24,25 This acid mantle discourages bacterial colonization and promotes retention of moisture in the skin barrier. The pH of a skin cleanser influences the skin’s acid mantle. Because repeated washings with an alkaline soap increase the skin’s pH, a cleansing product with a pH of 4 to 7 is recommended.26 Selection of a product with a pH between 4 and 7 is particularly important for elderly patients because their skin is dryer, more prone to cracking, and slower to recover from the effects of cleansing with a product that alkalinizes the skin.

Most bar cleansers have a pH of 7 to 11.24 Fortunately, ingredients can be added to bar cleansers to adjust or compensate for this high pH. Common pH adjusters are citric acid, phosphoric acid, sodium hydroxide, and triethanolamine. Unfortunately, these ingredients also tend to cause the bar to form a gelatinous material on and below its surface that serves as an excellent media for bacterial growth. This disadvantage may be alleviated by adding a filler such as dextrin or starch. Drawbacks to fillers are a rough surface texture and loss of slip (ie, the bar does not slide or slip across the skin as well). Unfortunately, the pH is not usually listed on the product package, and it is often necessary to ask the company for the pH of a particular product.

Bar Versus Liquid Cleansers

Much has been written and debated regarding the use of bar versus liquid skin cleansers in relation to infection control.5,18,27-35 Some infection control experts contend that bar soaps are frequently misused because they are typically stored in contact with moisture. The resulting jelly mass is unsightly, difficult to use effectively, and may harbor live pathogenic bacteria.35

Bar soap was included in one study of objects in the health care setting that were subjected to use by multiple persons.27 The researchers isolated several strains of Pseudomonas from 45 of 353 environmental samples used by multiple providers (13%) and found that the 5 most common strains were frequently found on patients. They also affirmed that the hands are a major vehicle for the transfer of Pseudomonas bacteria and implicated bar soap in its spread.27,35 Other researchers have found that bacteria survive on soap bars in continuous use in public lavatories, even when cultured 48 hours following their last use.28

The role of the soap dish in infection control has also been studied.19 Swabs were collected from soap dishes on 6 wards and from a bacteriology laboratory on 4 consecutive days. The sludge of the dish was found to be colonized with predominantly gram-negative bacteria. This
Some infection control experts contend that bar soaps are frequently misused because they are typically stored in contact with moisture.
This distinction is clinically relevant because clinicians can easily misinterpret a product claim such as "effective against MRSA" as implying use of the cleanser removes MRSA from skin.

Product Testing Data

Before marketing a skin cleanser, the product may be tested for safety and function\(^{40,41}\) (Table 2). If safety testing is not done, a warning statement must be applied to the package. Provided safety testing has been completed, the manufacturer can supply a summary of the safety tests that have been performed on a specific product. These tests should evaluate stability, potential for allergy, dermal irritancy, and preservative efficacy. Antimicrobial effectiveness should also be demonstrated when indicated using an in vitro minimum inhibitory concentration technique or an in vivo time kill study technique using human subjects. When reviewing product safety data, it should be emphasized that a preservative challenge test implies that a certain type of microorganism is not likely to grow inside the product. This test was not designed to indicate the effect of the product on the skin. This distinction is clinically relevant because clinicians can easily misinterpret a product claim such as "effective against MRSA" as implying use of the cleanser removes MRSA from skin. Instead, the correct interpretation of such a claim is limited to testing that demonstrated that MRSA does not grow when placed in the product package or on an object other than human skin.

### Table 2. Examples of product tests

<table>
<thead>
<tr>
<th>Test</th>
<th>Feature(s) tested</th>
<th>Basic description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stability test</td>
<td>Odor, pH, viscosity</td>
<td>An in vitro test that measures the degree of resistance to chemical changes of a formula(^{43})</td>
</tr>
<tr>
<td>Potential for allergy</td>
<td>Potential for allergy</td>
<td>Human repeat insult patch test in vivo on healthy humans or animals(^{40,41})</td>
</tr>
<tr>
<td>Dermal irritancy potential</td>
<td>Dermal irritancy potential</td>
<td>In vivo on healthy humans(^{40,41}) 14-day cumulative irritation with challenge test.</td>
</tr>
<tr>
<td>Preservative challenge*</td>
<td>Prevention from microbial contamination</td>
<td>Microorganisms are introduced in vitro to the product and evaluated over a period of 28 days(^{43}); preservative efficacy is ≥99.9% reduction of viable bacterial within 14 days, and maintenance at these levels for the remainder of the test period†</td>
</tr>
<tr>
<td>Time kill study</td>
<td>Rapid microbial kill rate</td>
<td>Measures the time that an antimicrobial product takes to reduce microbial contamination of the skin to an acceptable level</td>
</tr>
</tbody>
</table>

*A product "effective against methicillin-resistant Staphylococcus aureus" does not necessarily mean it removes methicillin-resistant Staphylococcus aureus from skin; it could simply meet the preservative challenge test.
†Celsis Laboratory Group, New Jersey Division, Edison, NJ 08837.
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REFERENCES