

Effectiveness of Hand Scrubbing

EXERCISE 26

People are sick because they are poor; they BECOME POORER because they are sick, and they BECOME SICKER because they are poorer.
— ANONYMOUS



MICROBIOME

OBJECTIVES

After completing this exercise, you should be able to:

1. Evaluate the effectiveness of handwashing and a surgical scrub.
2. Explain the importance of aseptic technique in the hospital environment.

BACKGROUND

The skin is sterile during fetal development. After birth, a baby's skin is colonized by many bacteria for the rest of its life. As an individual ages and changes environments, the microbial population changes to match the environmental conditions. The microorganisms that are more or less permanent are called **normal microbiota** and comprise the **skin microbiome**. Microbes that are present only for days or weeks are referred to as **transient microbiota**.

Importance of Handwashing

Discovery of the importance of handwashing in preventing disease is credited to Ignaz Semmelweis at Vienna General Hospital in 1846. He noted that the lack of aseptic methods was directly related to the incidence of puerperal fever and other diseases. Medical students would go directly from the autopsy room to the patient's bedside and assist in child delivery without washing their hands. Less puerperal sepsis occurred in patients attended by midwives, who did not touch cadavers. Semmelweis ordered the medical students to wash their hands with a chloride of lime solution, a policy that caused the death rate due to puerperal sepsis to drop from 12% to 1.2% in one year. Guidelines from the Centers for Disease Control and Prevention (CDC) state that "handwashing is the single most important procedure for preventing healthcare-associated infections," yet studies in hospitals show healthcare providers wash their hands less than 50% of the times they should.*

*CDC, 2017. www.cdc.gov.

Clinical Handwashing

A layer of oil and the overlapping layers of cells of the skin prevent handwashing from removing all bacteria. Soap helps remove the oil, however, and scrubbing will maximize the removal of bacteria. Hospital procedures require personnel to wash their hands before attending a patient and to perform a complete surgical scrub—removing the transient and many of the resident microbiota—before surgery. Usually, 3 to 5 minutes of scrubbing with an antimicrobial soap will remove transient microbiota. The surgeon's skin is never sterilized. Only burning or scraping it off would achieve that.

In this exercise, we will examine the effectiveness of washing skin with soap and water and waterless hand cleaner. Only organisms capable of growing aerobically on nutrient agar will be observed. Because organisms with different nutritional and environmental requirements will not grow, this procedure will involve only a minimum number of the skin microbiota.

Materials

FIRST PERIOD

Petri plates containing nutrient agar (2)
Scrub brush
Bar soap or liquid soap (bring one from home)
Waterless hand cleaner

Technique Required

Colony morphology (Exercise 3)

PROCEDURE First Period

1. Select two nutrient agar plates.
 - a. Divide one nutrient agar plate into four quadrants. Label the sections 1 through 4. Label the plate "Water."
 - b. Divide the other nutrient agar plate into five sections. Label the sections 1 through 5. Label the plate "Soap." Which soap will you use? _____



INVESTIGATIVE
EXERCISE

210 EXERCISE 26: EFFECTIVENESS OF HAND SCRUBBING

- Use the “Water” plate first. Touch section 1 with your fingers, and wash well *without* soap for your normal handwashing time (**FIGURE 26.1**). Don’t touch the faucet with your “test” hand to turn the water off. Shake off excess water, and, while your hands are still wet, touch section 2. Do not dry your fingers with a towel. Wash again, and, while your hands are still wet, touch section 3. Wash a final time, and touch section 4. Touch the same fingers to the plate each time.
- Use your same hand on the plate labeled “Soap.” Wash well with soap, rinse, shake off the excess water, and then touch section 1.
- Wash again with soap, rinse, shake off the excess water, and then touch section 2.
- Using a brush and soap, scrub your hand for 2 minutes, rinse, and shake off the excess water; then touch section 3.
- Repeat the soap-and-brush scrub for 4 minutes, rinse, and shake off the excess water; then touch section 4.
- Let your hands air dry, then use a waterless hand-cleaning product on the hand that has not been washed with soap, rinse with water, and then touch section 5. What are the active ingredients in the product? _____
- Incubate the plates, inverted, at 35°C until the next period.
- Speculate on your expected results, and record them in your Laboratory Report.

PROCEDURE Second Period

Record the growth as (-) = no growth, (+) = minimum growth, (2+) = moderate growth, (3+) = heavy growth, and (4+) = maximum growth.

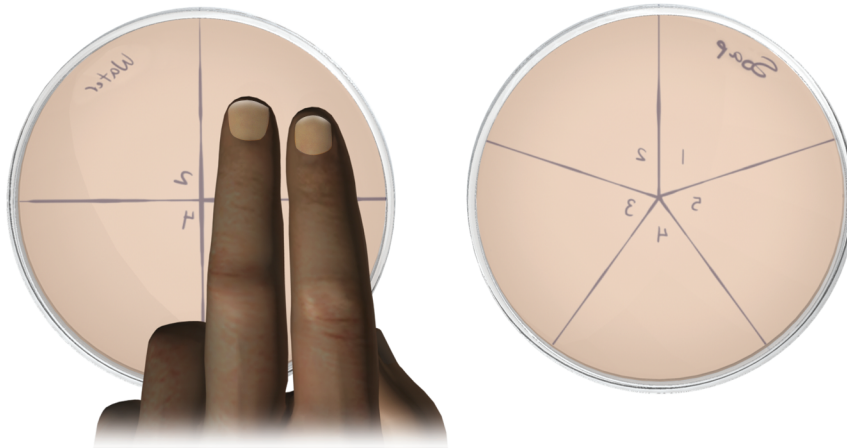


FIGURE 26.1 Touch the appropriate section of a plate after washing your hands.

Name: _____ Date: _____ Lab Section: _____



LABORATORY REPORT Effectiveness of Hand Scrubbing

EXERCISE 26

PURPOSE _____

EXPECTED RESULTS

Indicate the relative amounts of growth you *expect* in each quadrant on a scale of (-) to (4+).

Section	Water Alone	Soap
1.	(No washing)	
2.		
3.		
4.		
5.		(Waterless hand cleaner)

RESULTS

Indicate the relative amounts of growth in each quadrant.

Section	Water Alone	Soap (type: _____)
1.	(No washing)	
2.		
3.		
4.		
5.		(Waterless hand cleaner)

212 EXERCISE 26: EFFECTIVENESS OF HAND SCRUBBING

CONCLUSIONS

1. Did your results differ from your expected results? _____ Briefly explain why or why not. _____

2. Using your classmates' data, compare the results from bar soap and liquid soap. _____

QUESTIONS

1. Do waterless cleaners affect all bacteria? _____

2. What is a surgeon trying to accomplish with a 5-minute scrub with a brush followed by an antiseptic? _____

3. How do normal microbiota and transient microbiota differ? _____

CRITICAL THINKING

If most of the normal microbiota and transient microbiota aren't harmful on skin, then why must hands be scrubbed before surgery?

CLINICAL APPLICATION

The following data were collected from soaps after 1 week of use at a hospital nurses' handwashing station. Neither bacteria nor fungi were isolated from any of the products before use.

Aerobic bacteria were isolated from 25 soap products. Data are expressed as percentage of soap products contaminated.

Organisms	Bar Soap	Liquid Soap: Type of Closure			
		Screw Top	Slit/Flip	Flip/Pump	Pump
Total bacteria	95%	71%	39%	10%	0%
Gram-positive cocci	95%	71%	39%	10%	0%
Gram-negative rods	12%	1%	1%	1%	0%

What conclusions can you draw from these data?