The Challenge of Clean

There are no standards for measuring clean:
- How clean is clean?
- How clean is clean enough?
- How clean is safe?

Testing for clean:
- Takes time
- Costs money
- May require re-cleaning of the device due to contamination during the testing process
- Instrument manufacturer IFUs don’t always contain instructions for testing.

The Risk of Dirty

- 1 out of every 25 hospitalized patients contracts a healthcare-associated infection (HAI) annually in the US
- HAIs affect 1.7 million patients annually
- 100,000 deaths/year attributed to HAIs, making them one of the top 10 causes of death in the US (more than from AIDS, breast cancer and automobile accidents combined)
- HAIs account for at least $20 billion in excess healthcare costs/year
- Costs attributable to HAI average $21,000/patient
- 25% of HAIs are due to surgical site infections

Fun Fact

Q: What is a more hygienic tool for cleaning?
- Sponge
- Brush
- Washcloth

A: Brush. They are easier to clean and faster to dry.

Bacteria need three things to grow: moisture, food and temperature appropriate to the bacteria species. That means, if you deny it moisture and food, it dies. A brush 1) does not retain moisture and the surface moisture dries quickly and 2) allows a user to see the visible food. So at a minimum, rinse and dry. And whenever in doubt, throw it out!

Objectives

- Discuss the different brush materials available and their characteristics
- Explain antimicrobial properties of brushes
- Discuss the considerations when selecting a brush
- Explain the difference between single-use, disposable and reusable brushes and discuss how to clean and disinfect them
- Apply industry guidelines to all the above objectives
- Discuss the risk of not following recommended practices and manufacturer’s IFU when using brushes
History of the Brush

1498: Emperor of China patented the 1st toothbrush made of hogback bristles set into a piece of bone or bamboo

1780: William Addis (England) began importing coarse boar bristles from Siberia & Northern China for quality mass-produced toothbrushes

1844: Meyer Rhein patented the 3-row toothbrush

WWI: Celluloid plastic brush handles appear because all bones were needed for soup

1932: Modern plastic toilet bowl brush was introduced

1938: Dr. West’s Miracle Tuft Toothbrush was made with nylon bristles, a new invention from DuPont

1940’s: Fuller Brush Company supplied the military with 40 million brushes for cleaning weapons

Brush Terminology

**Bristles:** part of the brush that does the work
Three types of bristle filament (fill) material
- Synthetic: man-made
- Natural: hair, bristle or vegetable fiber
- Wire: strands of metal

**Handle:** part of the brush that holds the bristles in place
Popular handle materials include
- Twisted stainless steel
- Molded plastic blocks
- Rigid/semi rigid tubing/rods
- Spring coil stainless steel wire

Bristle Materials

<table>
<thead>
<tr>
<th>Material</th>
<th>Characteristics</th>
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<tbody>
<tr>
<td><strong>Nylon (Synthetic)</strong></td>
<td>Toughest, most durable synthetic filament available&lt;br&gt;Non-shedding&lt;br&gt;Excellent abrasion resistance&lt;br&gt;Excellent bristle bend recovery&lt;br&gt;Very good chemical resistance: resists most acids&lt;br&gt;Best choice for abrasive, rough use as it does not scratch most surfaces</td>
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<tr>
<td><strong>Polypropylene (Synthetic)</strong></td>
<td>One of the most chemically resistant synthetic filament materials, especially strong acids and bases&lt;br&gt;Does not absorb moisture so maintains stiffness when wet&lt;br&gt;Excellent resistance to fungal and bacterial growth&lt;br&gt;Flex fatigue resistance (bristles don't splay or break)&lt;br&gt;Good abrasion resistance&lt;br&gt;Doesn't shed easily&lt;br&gt;Inert to most solvents, oils and chemicals</td>
</tr>
<tr>
<td><strong>Stainless Steel</strong></td>
<td>Highly resistant to corrosion, heat and chemicals&lt;br&gt;Excellent bend recovery&lt;br&gt;Provides high degree of abrasion and wear resistance&lt;br&gt;Not to be used on insulated or coated instruments&lt;br&gt;Excellent for more aggressive cleaning (i.e. serrations, box locks)&lt;br&gt;Also available in a softer stainless version (.003&quot; vs .008&quot; filament)</td>
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Note: Use stainless steel brushes instead of carbon steel wire, which is a stronger, more aggressive bristle that can damage instruments.

**Abrasion Resistance**
- Property which allows a material to resist wear; will resist erosion caused by scraping, rubbing and other mechanical wear
- Allows the material to retain its integrity and hold its form

**Bristle Bend Recovery**
- Ability of a material to return to its original shape after deformation
- Determined by measuring the ability of a filament to straighten out after bending

**Corrosion Resistance**
- Gradual destruction of material, usually metals, by chemical reaction
- Ability to fight off electrochemical oxidation attacks (rust)

**Flex Fatigue/Non-Shedding**
- Measure of a material’s resistance to splitting or breaking
What is an antimicrobial?
- A substance that kills or inhibits the growth of microorganisms such as bacteria, fungi or protozoans.
- Can be antibiotics or synthetically formed compounds.

What are antimicrobial bristles?
- Bristles, usually nylon, that have been either coated or inbuilt with an inorganic antimicrobial material.
  - Coated: antimicrobial material is applied to the surface area of the bristle filament.
  - Inbuilt: antimicrobial material is infused in the bristle filament during the manufacturing of the filament.

What is the benefit of antimicrobial bristles?
- Providing superior infection control properties by preventing the growth of bacteria, mold and yeast on the surface of the bristles.

How does this affect the brush bristles?
- There is no impact to the fit, form or function of the brush or its cleaning capabilities.
- The resistance of bacterial growth slows the breakdown of the bristle material, which may prolong the useful life of the bristles.

Does this mean antimicrobial brushes clean better?
- NO – they do not improve the cleaning properties nor do they prevent specimen growth on the surfaces being cleaned.

**Brush Selection**

**One Size Does Not Fit All**

Only brushes designated or designed for use in cleaning of instruments & devices should be used.
- **AST Recommended Standards of Practice for the Decontamination of Surgical Instruments**, pg. 5
- **ANSI/AAMI ST79:2010**, section 7.5.3.2, pg. 57

Instruments with lumens should be brushed using a brush that is of the correct size for the lumen... Brushes should be ... the appropriate size and bristle type.
- **ANSI/AAMI ST79:2010**, section 7.5.6, pg. 59

Use cleaning brushes appropriate for the size of the endoscope channel or port.
- **CDC Guideline for Disinfection and Sterilization in Healthcare Facilities**, 2008, pg. 86

**Feature Consideration Risk**

- **Brush Diameter**
  - Too large
    - Brush diameter should be no more than 1/8" larger than the channel.
    - Bristles lay against walls of the lumen and don’t produce enough friction for scrubbing.
  - Too small
    - Brush diameter should be no smaller than the actual channel diameter.
    - Bristles don’t touch the walls of the lumen, providing no scrubbing action necessary for cleaning.

- **Brush Length**
  - Too short
    - Brush should be at least 2" longer than the channel being cleaned.
    - Doesn’t clean entire length of channel.
    - Unable to push dirt through open end.

Key to efficiency is **maximum bristle tip contact to surface** and the **proper type of bristle** for the surface being cleaned.

4/5/2017
Brush Selection
One Size Does Not Fit All

Feature | Consideration | Risk
---|---|---
Brush Handle | Loop end | Looped ends prevent the brush from reaching the full length of the lumen and getting stuck
| | Improper storage of brushes between uses can damage the bristles and promote the growth of biofilms
| | Brush can become lodged inside of lumen, causing damage to the device
| | Repeated cleaning action may cause kinks in the brush handle, which lead to damage of the lumen walls

Brush Tip | Brush tip | Not all tip styles clean the same way and could damage lumens and devices
| Acrylic and standard tips are best with open ended channels |
| | Ends of closed-ended lumens pose a cleaning challenge as dirt is difficult to reach and can become caked onto surface

Bristle Area | Amount of bristle area is proportionate to size of device being cleaned |
| | Too long of an area may result in brushes extending out of channel during cleaning motion, resulting in splatter spray from exposed bristles
| | Too short of an area may not provide efficient cleaning and result in loss of time

Bristle Material | Bristle material should be suitable for the material of the device being cleaned |
| | Harder bristle materials could damage the surface of the instrument or device
| | Soft bristle material will not provide abrasive scrubbing action for difficult to remove soils
| | Cleaning agents and chemicals can have different effects on the various bristle materials, causing them to breakdown, shed or otherwise impact the ability to clean effectively

Device Being Cleaned | Brush recommendation from device manufacturer’s IFU |
| | Device manufacture has validated cleaning instructions with a specific type or size of brush other than what is available
| | Damage to devices and ineffective cleaning
| | More soiled devices require more rigorous cleaning applications so more aggressive brushes may be required
| | More soluble devices require more aggressive brushing
| | Reuse of brushes after use on some types of instrument sets may increase risk of patient harm

Cleaning of Reusable Brushes

“Brushes must be cleaned and disinfected/sterilized... Prompt cleaning of brushes and cleaning tools reduces the number of or eliminates microorganisms that create biofilm.”


“Reusable brushes should be disinfected or sterilized at least daily. Disposable cleaning tools should be discarded after use.”

ANSI/AAMI ST79:2010, section 7.5.6, pg. 59

“Brushes used for decontamination must themselves be cleaned and disinfected or sterilized... Prompt cleaning of brushes and other cleaning implements reduces or eliminates biofilm-forming microorganisms and thus minimizes the formation of biofilm.”

ANSI/AAMI ST79:2010, section 7.5.6, pg. 59

“Reusable brushes should be cleaned and disinfected at least daily or when heavily soiled.”

A2T Recommended Standards of Practice for the Decontamination of Surgical Instruments, pg. 5

BRUSH USE AND DISPOSAL

SINGLE-USE
Intended for one-time use (i.e., one instrument)

Safest & easiest way to minimize cross-contamination

EXPENSIVE TO REPLACE BRUSHES SO OFTEN

DISPOSABLE / REUSABLE
Intended to be used once, or until no longer useful, and then thrown away

INCREASED RISK OF CROSS-CONTAMINATION
Cleaning of Reusable Brushes

During use:
- Clean in detergent each time it emerges from the channel or lumen; repeat until the brush emerges free of soil
- Cleaning prevents reintroduction of soil back into the lumen

After use:
- Rinse gross soils from the brush in a deep sink
- Rinse prevents the spraying of soils into the air and onto the user
- Use an instrument detergent or enzymatic cleaner in a washer disinfector, ultrasonic cleaner or by manually agitating the bristles under water; repeat until bristles appear free of soil
- Type of cleaner depends on types of soil the brush came in contact with during cleaning. Ineffective cleaning of brushes increases disinfection failures and cross-contamination.

After cleaning:
- Cleaned brushes may be thermally disinfected in the automated washer disinfection stage or with liquid chemical sterilants
- Check with disinfectant manufacturer for compatibility concerns with brush materials
- Follow the brush manufacturer’s IFU for HLD and/or sterilization
- **Reusable scope brushes should be high-level disinfected or sterilized after EVERY use on a single scope**

Sterilization:
- Always check with the brush manufacturer before sterilizing—can brushes be sterilized after use or only prior to initial use?
- Sterilization can happen providing that brushes are clean enough to be sterilized and IFU’s have validated sterilization after use

FUN FACT

Q: Your toothbrush has an average of 10 million germs on it. Therefore you should sterilize your toothbrush weekly to prevent the growth of bacteria such as E.coli, staphylococci, streptococcus and candida. True or False?

A: False!
The ADA recommends rinsing brushes thoroughly after use and allow to air-dry; do not share or let family brushes touch one another; and replace every three to four months or sooner if bristles are worn or splayed.

Inspecting Brushes

How Do I Know When to Replace?

Inspect brushes for:
- Wear, fraying or damaged bristles
- Kinks or bends in the brush handle
- Residual organic soil

Final Thoughts

“I am only one, but I am still one;
I cannot do everything, but I can do something;
and because I cannot do everything,
I will not refuse to do the something that I can do.”

- Edward Everett Hale
  (1822 – 1909)

Brush Selection

Risk Summary

Risks associated with improper brush use include:
- Ineffective removal of biofilms resulting in patient harm
- Damage to device
- Damage to the brush resulting in broken bristles or stems being left in device
- Additional time required for re-cleaning
Sources

- ANSI/AAMI ST79:2010
- AST Standards of Practice for the Decontamination of Surgical Instruments: 2009

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Keep Educating Yourself!