# Flash sterilization and instrument tape
## An experimental study

**Abstract** *A letter appearing in the* AORN Journal *questioned whether flash sterilization is appropriate for instruments coded with color identification tape. The reply stated that porous, colored tape required a longer time to penetrate and sterilize the area beneath, and thus if it should peel off, the zone beneath might not be sterile. This conclusion was, as far as we can determine, reached by intuitive reasoning and not by experimental evidence. Therefore, the following experimental approach was undertaken to test the hypothesis. Spores on discs were placed between the color-code tape and a metal instrument. Exposure to heat (135°C) and time (3 min.) was in a gravity displacement sterilizer. We then determined whether spore kill has been achieved. The test organism was* B. stearothermophilus. *None of the discs that were in contact with the instruments while being sterilized showed any growth. Thus, it appears that sterility can be achieved on the instrument surfaces that are beneath color-code tape in three minutes.*

by David A. Kostyal, PhD, John M. Verhage, Donald H. Beezhold, PhD, and William C. Beck, MD, FACS

Without doubt, flash sterilization has saved lives. Consider, for example, during a complicated operation, an important and unique instrument slips off the table and falls to the floor. It is sorely needed and the operation comes to a standstill until the instrument is resterilized and returned. Every minute may count; thus flash sterilization is invaluable.

A letter appearing in the *AORN Journal* questioned whether flash sterilization is appropriate for instruments coded with color identification tape.[1] In response, perioperative nursing specialist and *AORN Journal* columnist Mary O'Neale stated the exposure time recommended by AAMI[2] "for metal instruments only (ie. no porous items or items with lumens) is three minutes at or above 270°F (132.2°C) in a gravity displacement sterilizer. Examples of porous items are rubber, towels, plastics and colored tape. When nonporous items and porous items are combined the minimum exposure time is ten minutes at or about 270°F (132.2°C) in a gravity displacement sterilizer." The author went on to state that porous, colored tape required a longer time to penetrate and sterilize the area beneath, and thus if it should peel off, the zone beneath might not be sterile.[3]

This conclusion was, as far as we can determine, reached by intuitive reasoning and not by experimental evidence. As metal is an excellent heat conductor, and the tape is not hermetically sealed at the edges, we reasoned that the area beneath the color-code tape would be exposed to sufficient steam to effect sterility. If this is indeed correct, it might well save seven valuable minutes in a significant operation. Therefore, the following experimental approach was undertaken to test the hypothesis.

### Experimental design and procedure

**Experimental design.** Spores are placed between the color-code tape and a metal instrument. Exposure to heat (135°C) and time (3 min.) is in a gravity displacement sterilizer. We then determine whether spore kill has been achieved. The test organism is *B. stearothermophilus.*

**Experimental procedure.** FLASH/PROOF (AMSCO Medical Products, Erie, PA) biological chemical indicator vials were opened and the *B. stearothermophilus* spore-coated discs were removed. The plastic vials containing the media were then sterilized. The discs were attached to the glue side of a 1.5 cm long strip of tape (Oxboro Medical, Minneapolis, MN). The disc was then taped onto the surgical instrument and secured by wrapping the tape around the instrument. Thus, each disc was in direct contact with the metal instrument and completely covered by tape. At least two discs were attached to each of four surgical instruments. Instruments were stored

**Table 1**
**Killing of *B. stearothermophilus* spores by flash sterilization**

| Sample | Control | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| Nonsterilized | + | + | + | + | + | + |
| Sterilized | - | - | - | - | - | - |

Discs containing *B. stearothermophilus* spores were attached to surgical instruments with a piece of color-code identification tape. Discs were then removed before (top row) AND after a three-minute flash sterilization cycle(bottom row), placed in bacterial broth and incubated for 48 h at 55°C. A plus (+) indicates a color change of the bacteriological culture medium and growth of *B. stearothermophilus* while (-) represents no growth. Discs were taped to the following instruments: 1,2 large Rt. Angle Clamp; 3 Allis; 4 Lahey; 5 a pair of large forceps.

overnight at room temperature. In the morning, one of the discs was cut from the instrument and returned to the sterile FLASH/PROOF plastic vial containing the bacteriological culture medium. The instruments were flash sterilized (3 min., 135°C, Castle Steam Sterilizer, MDT Corporation) after which the remaining disc was removed using aseptic technique, and placed in the media. A FLASH/PROOF vial that had not undergone sterilization served as a positive control for spore viability, while one vial that had been sterilized served as a control for the effectiveness of the sterilization procedure. Vials were incubated according to the manufacturer's instructions at 55°C for two days to detect any growth.

## Results and discussion

We chose to use *B. sterothermophilus* spores as an indicator, because they are extremely heat-resistant. Thus, the absence of viable spores would indicate that the conditions are adequate for complete sterilization. As expected, all of the control discs that were in contact with the instruments, but not subjected to sterilization, were positive for growth, as was the positive control (see *Table 1*). None of the discs that were in contact with the instruments while being sterilized showed any growth nor did the sterilized control.

Thus, it appears that sterility can be achieved on the instrument surfaces that are beneath the color-code tape. Since there must be contact with steam in order to sterilize in the times used in this procedure, we believe that the spore kill was probably achieved by a combination of factors, including steam penetrating the tape, plus steam generated by the hot metal, acting upon the atmospheric moisture trapped in the micro environment of the air space around the spore strip and in the adhesive. The results happened rapidly enough to suggest that there is no need to increase the three-minute sterilization time when color-code identification tape is used on surgical instruments.

## References


1. Fenton, C. Flash Sterilization. *AORN Journal* 1992:424.
2. American National Standards Institute/Association for the Advancement of Medical Instrumentation. *Good Hospital Practices: Flash sterilization-steam sterilization of patient care items for immediate use.* 1992. ST37-1992 p7.
3. O'Neale, M. Flash sterilization, Response. *AORN Journal* 1992:424.


## The authors


*David A. Kostyal, PhD, is Research Associate, Laboratory of Macrophage Biology at the Donald Guthrie Foundation for Medical Research in Sayre, PA.*

*John M. Verhage is Master Mechanic at the Robert Packer Hospital in Sayre, PA.*

*Donald H. Beezhold, PhD, is Associate Research Scientist and Director, Laboratory of Macrophage Biology at the Donald Guthrie Foundation for Medical Research in Sayre, PA.*

*William C. Beck, MD, FACS, is President Emeritus at the Donald Guthrie Foundation for Medical Research in Sayre, PA.*


*We checked with Ken Blake, Vice President of Research & Development at Scanlan International, the manufacturer of Surg-I-Band® identification tape for over 28 years to confirm these findings. Scanlan's testing covered all commonly used steam sterilization cycles, including flash sterilization and was done by independent laboratories.*

*Pre-cut test samples of tape were inoculated on their adhesive surfaces with a certified spore suspension of B. stearothermophilus at a level of approximately 105 CFU each. Strips were attached to glass slides as well as metal forceps. The test samples were then exposed to a three-minute flash cycle.*

*The inoculated product samples were tested for sterility by removing each from its carrier and transferring into 40 ml culture tubes of tryptocase soy broth. After incubating for 7 days at 55° –65°C, the samples were removed and read for any signs of growth.*

*All samples were negative for growth.*