Changes in the Light Intensity of the Fiberoptic Laryngoscope Blade by Steam Sterilization

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BACKGROUND: I investigated the effects of steam sterilization on light intensity of reusable fiberoptic laryngoscope blades.
METHODS: Six new reusable fiberoptic Macintosh laryngoscope blades were steam sterilized. The light intensity was measured, the tip of the blades was photographed, and the light intensity of six new plastic disposable Macintosh laryngoscope blades was also measured.
RESULTS: The light intensity of reusable blades exceeded that of the disposable blades after 20 sterilizations, but was significantly lower after 80 sterilizations. The photographs showed irregular lighting of the blades, which increased with repeated sterilization.
CONCLUSIONS: Disposable plastic blades provide more illumination than reusable fiberoptic blades subjected to repeated sterilization.
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Laryngoscopy is an invasive procedure involving contact with mucous membranes, saliva, and blood (1). Laryngoscope blades may become contaminated by lymphoid tissue during routine laryngoscopy for tracheal intubation (2). Therefore, infectious diseases might be transmitted from inadequately washed laryngoscope blades. Steam sterilization is the only method that reliably decontaminates laryngoscopy blades (3) even though many hospitals do not routinely use it (4).

One of the potential disadvantages of steam sterilization is that it can reduce the light intensity of fiberoptic laryngoscope blades (5).

In contrast, single-use disposable laryngoscope blades carry no risk of infectious contamination, but there is a concern that they are less bright than conventional blades.

The present study investigated the effects of steam sterilization on the light intensity of conventional reusable fiberoptic blades and compared this with the light intensity of single-use disposable blades.

METHODS

This was a laboratory study that involved no human or animals subjects, and thus IRB approval was not required. Six new reusable fiberoptic Macintosh size 3 laryngoscope blades (Diamond Fiberlight Laryngoscope, Penlon, Abingdon, UK) were steam-sterilized 80 times (10 times per week) at 135°C for 10 min with an internal pressure of 0.22 MPa (Steam sterilizer SRN type, Miura Protec, Matsuyama, Japan).

The blades were tested with 2.5-V bulbs as provided by the manufacturer. Light intensity was measured using a light meter (EL-1000, Line Seiki, Tokyo, Japan) under a fluorescent light (550 Lux). For measurement, the tip of the laryngoscope blade was positioned against the edge of the sensor of the light meter to obtain the maximum light intensity. The results were expressed in Lux. The measurement was done before sterilization and after every 10 sterilizations. For each measurement, new 1.5-V batteries were

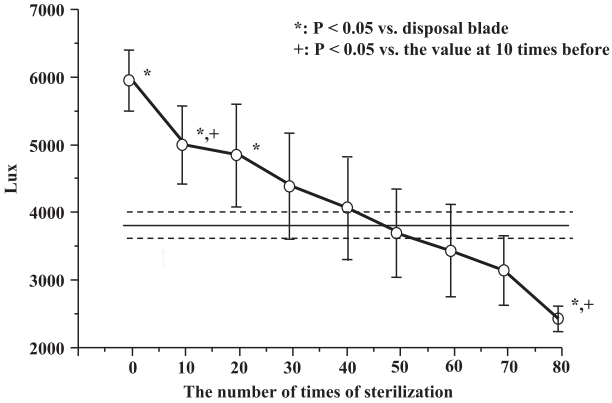

Figure 1. Light intensity. Closed circles with bars show mean ± SD of the light intensity of reusable blades (n = 6). Horizontal rigid and dotted lines show mean ± SD of the light intensity of disposable blades (n = 6).

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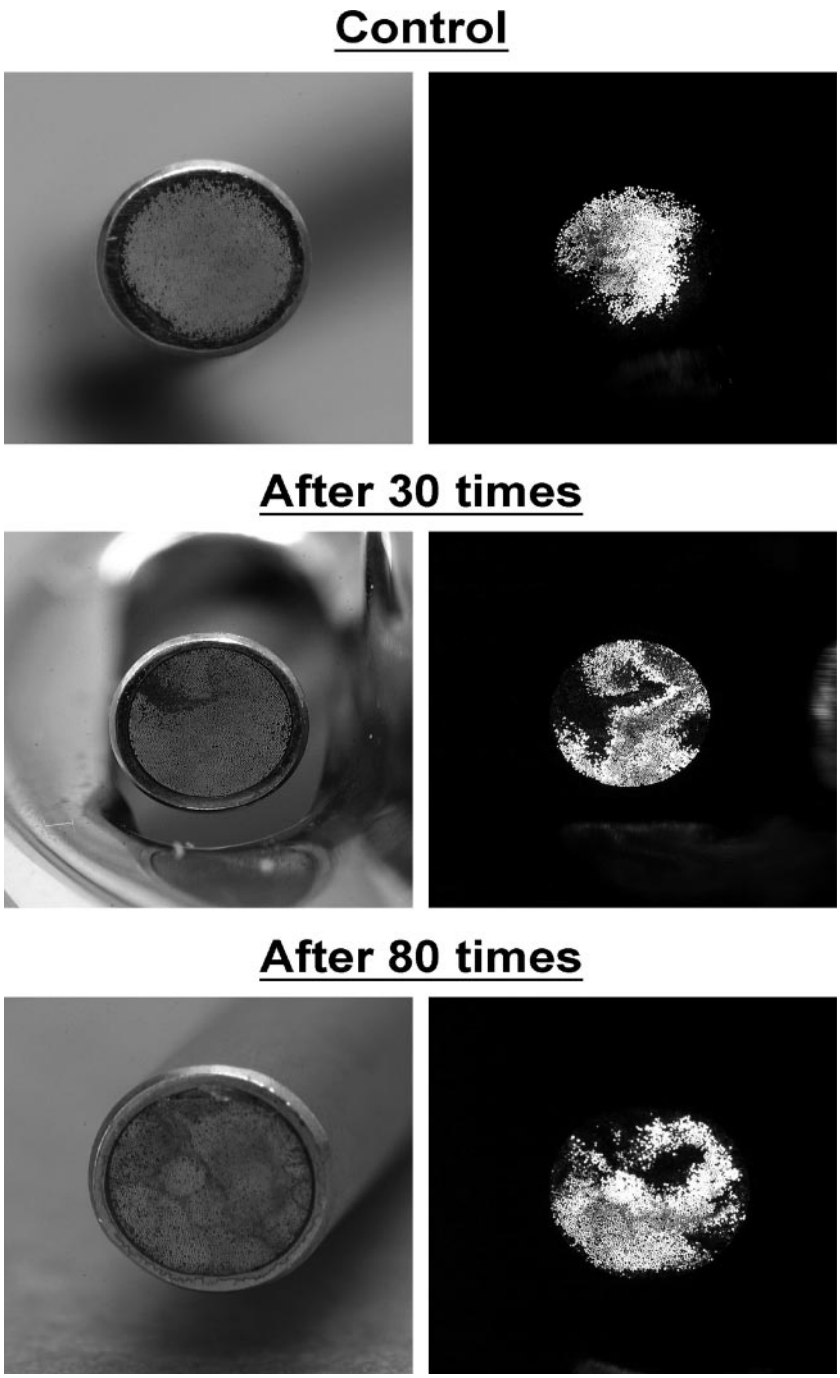

Figure 2. Photographs of the tip of the blade. The left side is plain and the right side is lighted.

used after verifying full charge. For comparison, we also measured the light intensity of six new plastic disposable Macintosh size 3 laryngoscope blades (Crystal Laryngoscope, Penlon). The tips of the reusable blades were also photographed at the beginning of the study and after every 10 sterilizations.

The light intensity between the reusable blades and the disposable blades was compared with analysis of variance (ANOVA). Changes in light intensity of reusable blades were analyzed with the repeated measures ANOVA followed by Student-Newman-Keuls test as a *post hoc* analysis. A P value <0.05 was considered to be statistically significant.

RESULTS

The light intensity of reusable blades decreased with sterilization (Fig. 1). The light intensity of reusable blades was significantly higher than that of disposable blades until 20 sterilizations, but was significantly lower after 80 sterilizations. Figure 2 shows the irregular lighting of the surface of the tip of the blades before sterilization. The irregularity increased as sterilization continued.

DISCUSSION

Reusable fiberoptic laryngoscope blades deteriorate with repeated steam sterilization, eventually becoming less bright than single-use disposable plastic la-

ryngoscope blades. The decrease in light intensity may be due to the deterioration of the surface of the fibers.

Prior studies have shown that the light intensity of reusable fiberoptic laryngoscope blades decreases with repeated cleaning (5,6). Fiberoptic laryngoscope blades were fairly resistant to the damaging effects of machine washing and disinfection at 90°C. However, when exposed to a machine washing and sterilization at 134°C, light intensity of the same fiberoptic laryngoscope blades that we used decreased 75% after 75 cycles of washing and sterilization (6). This is consistent with our results showing a 50%–60% reduction in light intensity after 80 steam sterilizations without washing.

In contrast, single-use plastic disposable laryngoscope blades are not washed and sterilized. As a result, they have a constant light intensity. Prior studies have suggested that the brightness of plastic disposable laryngoscope blades exceeds that of conventional fiberoptic laryngoscope blades (7,8). We could not confirm this, but our fiberoptic blades were new, while the prior study used blades that had already been used, perhaps subjecting them to damage.

Another concern with plastic disposable blades is rigidity. The use of plastic blades results in greater peak force and duration of laryngoscopy (9). In emergency cases using rapid induction, the rate of failed intubation was higher with plastic blades than with reusable blades (10). Our study did not consider these disadvantages with single-use plastic blades. The price of a reusable blade is about 20–40 times more than a disposable blade in Japan and 40–50 times more than in the United Kingdom (11). Therefore, we need to consider the rigidity and cost as well as brightness to select the blade.

In conclusion, if reusable fiberoptic laryngoscope blades are sterilized many times (e.g., far more than 40), then there may be a benefit to using single-use plastic blades.

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