Microbiological Sampling of the Forgotten Components of a Flexible Fiberoptic Laryngoscope: What Lessons Can We Learn?

Jay M. Bhatt, MD¹, Ellena M. Peterson, PhD², and Sunil P. Verma, MD¹

Materials and Methods

The University of California at Irvine Medical Center review board found this work to be exempt, as it fit in the category of non–human subjects research.

Samples were obtained during a busy outpatient otolaryngology clinic of a general adult outpatient clinic at a tertiary teaching hospital. Samples were taken of 6 random FFLs from the eyepiece and driver handle prior to use, as well as from the proximal and distal ends of 5 light cables. All FFLs underwent the clinic’s cleaning protocol: debridement with an enzymatic sponge of the shaft and body, tap water rinse, and immersion of the shaft in Cidex (2.5% glutaraldehyde; Metrex Research Corporation, Romulis, Michigan), followed by air drying.

Samples were obtained using culture swabs (BBL CultureSwab Plus Collection & Transport System; Becton Dickinson, Franklin Lakes, New Jersey) that were moistened with nonbacteriostatic saline.

Samples were delivered within 1 hour of collection to the UC Irvine Medical Microbiology laboratory, cultured onto 5% sheep blood agar (BBL), and incubated overnight at 35°C in 5% CO₂. Colonies were enumerated if \( \leq 10 \) per plate, and if \( \geq 20 \) per plate, they were rated as 1 to 4.

Results

From the 17 samples collected, there was bacterial growth in 7 (41%). The growth was low level, with 1 to 4 colonies recovered from 5 samples (see Table 1). There was 1+ growth in 7 (41%).

Due to a recent increase in safety awareness in health care, the flexible fiberoptic laryngoscope (FFL) has received considerable attention. Since the shaft of a FFL comes in contact with patients’ mucous membranes, it is considered a semi-critical instrument in the Spaulding Classification, thus requiring high-level disinfection.¹

There are numerous protocols for disinfection, but the most common disinfection technique addresses only the shaft of the laryngoscope.² There has been limited discussion on cleaning the noncritical portions of the flexible laryngoscope, including the eyepiece, handle, and light cord. Therefore, an investigation was performed to see if the noncritical portions of a laryngoscope could harbor organisms that represented clinical bacterial isolates.

Abstract

The effectiveness of a Cidex-based decontamination protocol was analyzed for its effectiveness in cleaning various components of a flexible fiberoptic laryngoscope (FFL), including the handle, eyepiece, and detachable light cable. A random microbiological sampling and aerobic bacterial culture analysis of 6 FFL eyepieces, 6 FFL driver handles, and 5 light cables prior to patient use was performed. Of 17 samples collected, 7 (41%) were contaminated with bacterial organisms. Organisms recovered represented both environmental organisms from skin and oral flora origin. This study demonstrates that potential contaminants may be present on FFL eyepieces and light cables, which are commonly overlooked in the cleaning protocols of a standard otolaryngology clinic.

Keywords

flexible fiberoptic laryngoscope, contamination, safety

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growth from 2 samples: 1 from the FFL eyepiece (normal oral flora) and the light handle (*Corynebacterium*). Other isolates recovered included a coagulase-negative *Staphylococcus*, *Bacillus* species, and a nonfermenting Gram-negative bacillus.

**Discussion**

Otolaryngology is a unique medical discipline in which mucosal barriers are examined in virtually every patient. To reduce the risk of contamination from mucosal surfaces, many otolaryngology clinics use an immersion protocol, known as high-level disinfection (HLD), which eliminates most organisms, including bacteria, mycobacteria, fungi, and most spores. However, there are variations in the HLD methods since there are no centrally regulated guidelines in the United States.

Numerous studies have critically evaluated FFL cleaning methods. Generally, immersion is deemed “reasonably effective” in reducing colonization with bacteria and fungi and achieves high-level disinfection as well. A concern for contamination of noncritical portions of otolaryngologic instruments has been raised previously, since up to 5% of FFL handles studied were contaminated after disinfection. However, to our knowledge, no study has analyzed ancillary FFL equipment such as light cables or the efficacy of immersion in addressing the eyepiece and driver knob.

The results from this study demonstrate that despite using a widely accepted method of HLD, noncritical portions of the laryngoscope can harbor organisms. Results suggest that stricter protocols for cleaning the laryngoscope eyepiece, handle, and light cords may be needed.

Of note, standard guidelines from FFL manufacturers recommend submersion of the entire laryngoscope in approved disinfectants, which would potentially decontaminate its subsites. In addition, manufacturer guidelines call for submersion of light cords in disinfectant solution as well.

Automated endoscope reprocessors can also be used to enhance cleaning. The use of a protective sheath is also an effective method for protecting laryngoscope but leaves contamination of accessory sites a possibility.

There are weaknesses to this study, the first being a small sample size. The efficacy changes proposed above should be examined as well. While in this study, no organisms considered pathogenic were recovered, a larger study would be needed to determine if this possibility exists and, more important, if this contamination can actually lead to a nosocomial infection.

**Conclusion**

This microbiological evaluation of common instruments such as the light cables for a flexible fiberoptic laryngoscope, along with its eyepiece and driver knob, demonstrates a potential for the presence of contaminants. Thus, per manufacturers’ recommendations, otolaryngology clinics are encouraged to modify the cleaning process to minimize hidden sources of contamination by addressing these highlighted areas.

**Author Contributions**

Jay M. Bhatt, study design, data acquisition, data interpretation, manuscript revision and finalization; Ellena M. Peterson, microbial analysis, data interpretation, manuscript revision and finalization; Sunil P. Verma, study design, data acquisition, data interpretation, manuscript revision and finalization, study supervision.

**Disclosures**

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**References**


Table 1. Number of positive cultures (and percentage of site total) by each site sampled.

<table>
<thead>
<tr>
<th>Source</th>
<th>No. of Scopes Sampled</th>
<th>No. (%) of Positive Cultures</th>
<th>Bacterial Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light cable</td>
<td>5</td>
<td>3 (60)</td>
<td><em>Corynebacterium</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><em>Bacillus</em> species</td>
</tr>
<tr>
<td>Driver</td>
<td>6</td>
<td>1 (17)</td>
<td>Gram-negative rod (nonfermentor)</td>
</tr>
<tr>
<td>Eyepiece</td>
<td>6</td>
<td>3 (50)</td>
<td><em>Bacillus</em> species</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Coagulase-negative <em>Staphylococcus</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Normal oral flora</td>
</tr>
<tr>
<td>Totals</td>
<td>17</td>
<td>7 (41)</td>
<td></td>
</tr>
</tbody>
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