Lead Apron Contamination Study
Barrier Technologies

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Executive Summary

X-ray protective aprons can be a source of bacterial contamination. The objective of this proposal was to determine bacterial contamination of X-ray protective aprons that are routinely used in dental clinics. Bacterial strains were isolated from the neck collar areas of 5 different X-ray protective aprons. Bacterial species were identified using molecular means.

Conclusions

Viable aerobic and anaerobic bacteria contaminate the inside and outside areas of the neck collars of X-ray protective aprons. Species identified are typical isolates from the skin, the oral cavity and the environment. Patients or clinicians may be at risk for transmission of potentially harmful bacterial contaminants.
Objective
This study was designed to determine bacterial contamination of X-ray protective aprons that are used in dental clinics.

Methods
Study Design: The neck collars of 5 aprons were sampled for the presence of viable bacteria. Sampling was done at the end of a regular clinic day at the Forsyth Institute dental clinics prior to daily decontamination procedures.

Sampling and Bacterial Identification
Sterile cotton swabs were dipped in sterile 0.01M TRIS buffer. Excess buffer was removed. Wet swabs were used to sample the neck collars. Two areas of the collars were sampled: 1) The entire inside surface (surface that comes in contact with patient’s neck or skin) of the collar (termed “Inside”) and 2) the area outside of the neck collar (termed “Outside”).

Immediately after sampling each site, swabs were streaked onto 2 Blood Agar media plates. One plate was incubated aerobically for 3 days and the other plate anaerobically for 7 days at 37°C. Representative bacterial colonies that developed were identified using 16S rRNA gene sequence analysis using a commercially-available service (GENEWIZ, Boston, MA). Resultant sequences were analyzed using BLAST vs the HOMD database (www.homd.org) or NCBI database. Such analyses are standard in our laboratories.

Results
Many isolates were obtained from all apron surfaces tested. The protocol was not set up for enumeration, but the number of resultant colonies per swab ranged from 10 to hundreds per plate as shown in Figure 1.

Representative colonies, based on apparent differences in colony morphology, were selected for bacterial identification. Overall, 5 to 10 isolates were selected from each plate with a final total of 83 isolates that were ultimately identified at the species level. Results are shown in
Table 1. In all, 26 different bacterial species were identified. Many were typical skin isolates (such as species of *Staphylococcus*), oral isolates (including species of *Streptococcus*, *Rothia* and *Neisseria*), and others considered as environmental isolates (such as *Micrococcus luteus* and species of *Pseudomonas*). Likely, these latter species were transient contaminants on the skin.

<table>
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<th>ID-BLAST search in HOMD or GenBank</th>
<th>Comments</th>
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<tr>
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</tbody>
</table>

*1 through 5 is apron number, I=inside neck collar, O=outside neck collar, AE-grown aerobically, AN=grown anaerobically, -# =isolate number. Thus, 1I-AE-1 is apron #1, inside collar, aerobically grown isolate #1.
Identification of clinics associated with tested apron is shown in Table 2. Typically, oral bacteria were isolated more frequently from aprons association with the pediatric clinic (apron #3). No oral surgeries were performed using any of the aprons for the day sampling.

Table 2. Clinic associated with apron.

<table>
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<tr>
<th>Apron number</th>
<th>Clinic or types of patients</th>
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<tbody>
<tr>
<td>1</td>
<td>Mainly used during endodontics and periodontics</td>
</tr>
<tr>
<td>2</td>
<td>Mainly used during implant surgeries and periodontics</td>
</tr>
<tr>
<td>3</td>
<td>Mainly used for routine pediatric patients</td>
</tr>
<tr>
<td>4</td>
<td>Mainly used for routine X-ray examination or prosthodontic procedures</td>
</tr>
<tr>
<td>5</td>
<td>Mainly used for CT-Scan</td>
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</tbody>
</table>

Conclusions

The inside and outside surfaces of neck collars of X-ray-protective aprons were contaminated with viable bacteria. Abundant bacterial growth on agar media, especially from the inner surfaces, was observed from all aprons.

The sources of the bacterial contamination were from the oral cavity, likely from saliva spilled from intraoral film holders, clinician’s gloved hands or patient’s mouth and from the skin of the patient. Typical oral bacterial species were identified, including species of *Streptococcus* and *Rothia*, and species commonly found on the skin, such as species of *Micrococcus* and *Staphylococcus*.

These contaminating bacteria are a possible source of cross-contamination. There is risk, albeit low, of transmission of potentially harmful bacteria to patients or clinicians. For example, if a patient had antibiotic resistant bacteria such as MRSA (Methicillin-resistant *Staphylococcus aureus*), there is the possibility of transmission. Although, MRSA was not detected in this study, *Pseudomonas luteola*, a known opportunistic pathogen, was detected on one of the tested aprons. Taken together, contaminated protective aprons routinely used in the dental clinics could pose a risk for microbial transmission to a susceptible host.