Assessment of Flocked Swabs for the Identification of Streptococcal Pharyngitis

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ABSTRACT
Background: Traditionally bacterial throat cultures have been obtained using wound-fiber swabs. A relatively recent innovation in swabs has been a design termed the ‘flocked’ swab. Traditional wound-fiber swabs entrap part of the sample in an internal core, thus preventing release onto growth media. However, flocked swabs spontaneously release sample when placed onto solid or liquid media. We compared the performance of flocked swabs to traditional swabs in identifying streptococcal pharyngitis in children presenting to a pediatric emergency department (ED). Methods: “Dual swabs” which contained both traditional wound-fiber swabs and flocked swabs attached to the same base were distributed through the ED and were obtained to obtain throat swabs from those with possible bacterial pharyngitis. After a clinician obtained the sample using the dual swab, the flocked swab was removed from the traditional swab and processed separately. The traditional swab was used to directly streak a 5% blood agar plate. The flocked swab was placed in liquid transport media. The transport tube containing the flocked swab was briefly vortexed and 100 microlitres of the liquid media was streaked onto a 5% blood agar plate. The flocked swab was then used to directly streak an additional 5% blood agar plate. A ‘true positive’ was defined as any growth of group A, C, or G streptococci known to cause pharyngitis. Results: A total of 334 dual throat swabs were collected during the three month study period. The flocked swabs were able to identify a significantly higher number of pathogenic Group A, C, or G streptococci (120 vs. 113 isolates; p < 0.02). All of the samples that were culture positive via the traditional swab were also culture positive via flocked swab. Sub-analysis of Group A streptococcal isolates revealed a trend towards improved isolation using the flocked swab technique (111 vs. 100 isolates; p=0.05). Conclusions: To our knowledge this is the first study of flocked swabs for the identification of streptococcal pharyngitis. In a head-to-head comparison with traditional swabs, flocked swabs were able to isolate pathogenic streptococci more frequently than throat cultures taken in a pediatric ED.

BACKGROUND
- Bacterial throat cultures are one of the most frequently submitted samples to the Microbiology laboratory.
- Although rapid antigen tests have been developed, culture remains the “Gold Standard” for diagnosis of streptococcal pharyngitis.
- Traditionally fiber-wound swabs are used that are then streaked onto blood agar plates.
- For traditional throat swab sensitivity is estimated to approach 80-95%.
- Several studies have shown the utility of flocked swabs for viral isolation, however they have not been demonstrated for use in bacterial culture.

FLOCKED SWABS
- Short nylon fibers are attached perpendicularly to the plastic applicator (see figure 1), using electrostatic field.
- Traditional swabs entrap part of the sample in an internal core, preventing release.
- Flocked swab has no core - entire sample stays close to the surface and is spontaneously released when the swab is placed onto solid or liquid media.
- Strong capillary hydraulics between the strands draws sample from the infected site into this hydrophilic layer.

PURPOSE
- The first head-to-head comparison of flocked vs. traditional swabs for culture identification of streptococcal pharyngitis.

METHODS
- All children in whom physician requires a bacterial throat culture were included in the study.
- Conducted in Children’s Hospital of Eastern Ontario (CHEO) Emergency Department in the Fall of 2007.
- ‘Dual swabs’ were developed on request by a flocked swab liquid transport manufacturer for use in this study (see figure 2).
- Traditional swabs streaked onto 5% blood agar plates.
- Each flocked swab used to streak two plates - 1) Swabs in liquid media initially vortexed for 30 seconds - 2) Swabs streaked on culture plate.
- 100 μl transport liquid streaked on separate plate.
- Any growth of Lancefield Group A or pathogenic Group C and G streptococci were considered positive.
- Two separate lab technologists worked to identify streptococcal isolates – blinded to the results of the other technologist.

RESULTS
- Total 350 dual swabs collected in 3 months.
- 6 swabs were excluded as improperly collected.
- 36% of dual swabs were positive.
- Flocked swabs did not miss any isolates that were identified via traditional swabs.

DISCUSSION
- Most sensitive was combined flocked swab and liquid.
- Laboratories likely to choose only one method.
- Benefit of being able to use the liquid for further testing – PCR.
- Would be able to identify rapidly and with potential even further sensitivity using PCR.
- Rapid testing for antibiotic susceptibility (for those penicillin allergic).
- Can potentially be used to identify other pathogens (e.g. Mycoplasma spp., N. gonorrhoeae, adenovirus).

CONCLUSION
- This is the first study to demonstrate the clinical utility of flocked swabs for bacterial culture.
- Flocked swabs are able to identify more cases of streptococcal pharyngitis than traditional swabs in a pediatric ED.
- Using flocked swabs in this context may allow for expanded diagnostics.

Table 1. Isolates

<table>
<thead>
<tr>
<th></th>
<th>GAS</th>
<th>GCS</th>
<th>GGS</th>
<th>Total</th>
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<tr>
<td>Traditional</td>
<td>109</td>
<td>3</td>
<td>4</td>
<td>116</td>
</tr>
<tr>
<td>Flocked Plate</td>
<td>113</td>
<td>3</td>
<td>5</td>
<td>121</td>
</tr>
<tr>
<td>Flocked Liquid</td>
<td>112</td>
<td>3</td>
<td>5</td>
<td>120</td>
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</table>

Table 2. Flocked vs. Traditional

<table>
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<th>Number of Isolates</th>
<th>Sensitivity relative to Flocked Combined</th>
<th>McNemar's Test vs. Traditional</th>
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<tbody>
<tr>
<td>Flocked Combined</td>
<td>123</td>
<td>100%</td>
</tr>
<tr>
<td>Flocked Plate</td>
<td>121</td>
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<tr>
<td>Flocked Liquid</td>
<td>120</td>
<td>98%</td>
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<tr>
<td>Traditional</td>
<td>116</td>
<td>94%</td>
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Table 3. Sensitivity Relative to Combined Flocked Swab

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<th>Flocked Liquid</th>
<th>Flocked Plate</th>
<th>Flocked Combined</th>
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<tr>
<td>95%</td>
<td>100%</td>
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ACKNOWLEDGEMENTS
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REFERENCES

Figure 1: Flocked swab (left), Traditional Swab (right)

Figure 2: The ‘Dual Swab’

Graphical representation of sensitivity relative to combined flocked swab.