Fluorescence aided caries excavation (FACE)

Development and validation of a method for detection and treatment of carious dentin

Áine M. Lennon

1. Is red fluorescence a good marker for infected dentin?

40 teeth

Group A
n = 20
red fluorescing dentin remaining

Group B
n = 20
red fluorescing dentin removed

1. Visual tactile
2. Caries Detector®

CLSM

excitation
λ = 370 – 440 nm

530 nm filter

1. Is red fluorescence a good marker for infected dentin?

2. Which oral bacteria emit red fluorescence?

<table>
<thead>
<tr>
<th>Bacteria</th>
<th>Red/green ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>S. sobrinus</td>
<td>0.90</td>
</tr>
<tr>
<td>F. nucleatum</td>
<td>0.91</td>
</tr>
<tr>
<td>S. mutans</td>
<td>0.91</td>
</tr>
<tr>
<td>S. salivarius</td>
<td>0.93</td>
</tr>
<tr>
<td>S. oralis</td>
<td>0.94</td>
</tr>
<tr>
<td>L. casei</td>
<td>1.18</td>
</tr>
<tr>
<td>L. rhamnosus</td>
<td>1.25</td>
</tr>
<tr>
<td>L. fermentans</td>
<td>1.34</td>
</tr>
<tr>
<td>A. israelii</td>
<td>1.49</td>
</tr>
<tr>
<td>A. naeslundii</td>
<td>1.88</td>
</tr>
<tr>
<td>P. intermedia</td>
<td>5.91</td>
</tr>
</tbody>
</table>

3. How does FACE compare to conventional excavation in a 3-dimensional cavity?

```
CLSM with EtBr

FACE

- Infected: 15%
- Free of bacteria: 85%

Conventional excavation

- Infected: 45%
- Free of bacteria: 55%

P = 0.037
```

4. Does more thorough removal of infected dentin result in larger cavities?

Lesion size [mm²] before excavation
Cavity volume [mm³] after excavation

Relative cavity size [mm] = \frac{\text{Cavity volume [mm³]}}{\text{Lesion size [mm²]}}

4. Does more thorough removal of infected dentin result in larger cavities?

<table>
<thead>
<tr>
<th></th>
<th>mean lesion size mm(^2) ± sd</th>
<th>mean rel. cavity size mm ± sd</th>
<th>pulp exposures</th>
</tr>
</thead>
<tbody>
<tr>
<td>FACE</td>
<td>9.2 ± 5.2</td>
<td>3.0 ± 1.3</td>
<td>0</td>
</tr>
<tr>
<td>Caries Detector(^\circledR)</td>
<td>9.2 ± 5.2</td>
<td>3.4 ± 1.4</td>
<td>10</td>
</tr>
<tr>
<td>Conventional excavation</td>
<td>9.2 ± 5.1</td>
<td>3.4 ± 2.8</td>
<td>0</td>
</tr>
</tbody>
</table>

![Graph showing bound stain (total pixel intensity)](image)

Conclusions

• caries autofluorescence is a reliable indicator of infected dentin

• of the bacterial species tested, those commonly found within the caries lesion in dentin produce red fluorescing compounds

• the incidence of bacterially infected dentin is significantly lower following FACE excavation compared to conventional excavation

• FACE is capable of more complete removal of infected dentin without significantly increasing the cavity size compared to conventional excavation methods
Before excavation: 
3.2 \(10^6\) CBU

After excavation: 
< 20 CBU
A. naeslundii
P. intermedia
F. nucleatum
A. naeslundii
P. intermedia