

## Diagnostic Accuracy of an optimised ac impedance device to aid caries detection and monitoring

Nigel B. Pitts<sup>a,b</sup>, Christopher Longbottom<sup>a,d</sup>, Andrew F. Half<sup>c</sup>, Agnieszka Czajczynska-Waszkiewicz<sup>d</sup>, Przemyslaw Los<sup>d</sup>, Marcin Masalski<sup>d</sup>, Przemyslaw Biecek<sup>d</sup>, A M Christie<sup>b</sup>.  
\*n.b.pitts@chs.dundee.ac.uk; <sup>a</sup>Univ. of Dundee Centre for Clinical Innovations, U.K.; <sup>b</sup>CarieScan Ltd, Dundee, U.K.; <sup>c</sup>Univ of Dundee Dental School, U.K.; <sup>d</sup>IDMoS, Dundee, U.K.

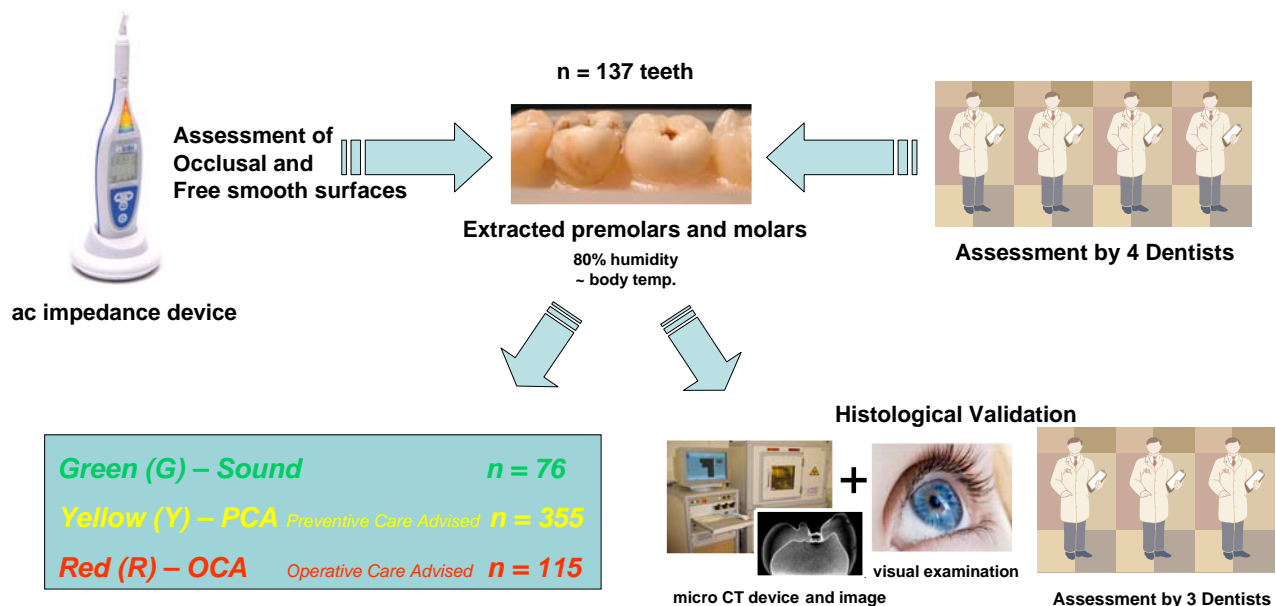
### Introduction

Accurate caries detection and an ability to monitor initial lesions over time are both important in modern clinical caries management. Traditional detection methods have recognised limitations in sensitivity, but enjoy high specificity, while newer methods typically trade-off decreased specificity for improved sensitivity.

### Aim

The aim of this work was to balance both components of diagnostic accuracy in an ac impedance device in order to be able to inform the dental team and patients.

### Materials & Methods



### Results

Occlusal

**Sensitivity: R vs G + Y = 92.5%**  
**Specificity: G vs Y + R = 92.5%**  
**Accuracy for Y alone = 79.4%**

Using a probability map method

Free smooth surface

**Sensitivity: R vs G + Y = 92.5%**  
**Specificity: G vs Y + R = 92.5%**  
**Accuracy for Y alone = 80.5%**

### Discussion

Modern clinical caries management Requires the consideration of three discrete conditions of tooth sites, not just a binary sound vs diseased “call”. The probability map method used here takes into account the prevalence of conditions in each of the three states: **sound**, **initial** lesions and **established** lesions and links results to possible treatment options.

### Conclusion

It is concluded that an ac impedance device can be optimized to aid caries detection and monitoring by displaying results with symmetrically high values for both sensitivity and specificity.

### Abstract

Accurate caries detection and an ability to monitor initial lesions over time are both important in modern clinical caries management. Traditional detection methods have recognised limitations in sensitivity, but enjoy high specificity, while newer methods typically trade-off decreased specificity for improved sensitivity. The aim of this work was to balance both components of diagnostic accuracy in an ac impedance device in order to be able to inform the dental team and patients. Building on earlier work (Los et al. Caries Res 2007; 41: 296), a device certified to international standards was developed with reference to repeatability data from an in vivo study with sensors adapted to occlusal and free smooth surfaces in the first instance. ac-Impedance measurements were undertaken by 4 dentists on 137 extracted teeth (80% humidity, ~ body temperature). Reference evaluations were a consensus of at least 3 dentists using micro-CT and magnified visual techniques. Results were presented in 3 groups: Green (G) – Sound, Yellow (Y) – caries where preventive care is advised and Red (R) – caries where operative care is advised. For occlusal surfaces: sensitivity (R vs G+Y) = 92.5%; specificity (G vs Y + R) = 92.5%; accuracy for Y lesions alone = 79.4%. For smooth surfaces: sensitivity (R vs G+Y) = 92.5%; specificity (G vs Y+R) = 92.5%; accuracy for Y lesions alone = 80.5%. The G/Y/R results are displayed as coloured LED pyramids on both sides of the device, for surfaces classified Y, an arbitrary number (1-99) is displayed on an LCD. It is concluded that an ac impedance device can be optimized to aid caries detection and monitoring by displaying results with symmetrically high values for both sensitivity and specificity.