Evaluation of inter- and intra-examiner reproducibility of The Canary System®

Abstract #: 1479

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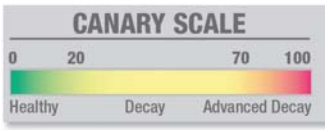
The Canary System®

❑Pulses of laser light (660 nm) are shone on the tooth and the laser light is converted to four signals during a 5 second scan: 1) The strength of the converted heat (PTR Amplitude); 2) The time delay of the converted heat to reach the surface (PTR Phase); 3)The strength of the converted luminescent light (LUM Amplitude); 4) The time delay of the converted luminescent light (LUM phase).

❑The Canary Number is created from an algorithm combining these four signals and is directly linked to the status of the enamel or root surface crystal structure. Changes in the tooth microstructure, due to caries, causes corresponding changes in the optical and thermal properties of the tooth and the resultant PTR-LUM response.

❑The Canary Scale is a relative scale that reflects the state of tooth mineralization, a measure of the integrity of the surface being scanned. This is a graduated scale where lower numbers suggest healthy enamel and higher numbers suggest the presence of tooth decay.



Objective

To examine the inter- and intra-examiner reproducibility of scanning smooth and occlusal surfaces with natural decay using The Canary System.

Materials & Methods

- ❑ A total of 185 examination sites (92 on smooth surfaces and 93 on occlusal surfaces of extracted human teeth), with status ranging from visually sound to natural dentinal caries, were investigated using the same Canary System.
- ❑ Two blinded operators, each trained and experienced in caries detection using The Canary System, independently performed three scan measurements for each site. Average Canary Number (CN) and standard deviation (STDEV) were calculated.
- ❑ Between each of the three measurements, the operator removed the tip of the hand piece from the site and counted a 10-second interval before re-positioning the tip onto the same site to take the next measurement.
- ❑ For each operator, the intra-examiner reproducibility of The Canary System was estimated by calculation of the examiner's intra-class correlation coefficient (ICC) using the three repeat measurements per site.
- ❑ The mean values of the three measurements per site was also recorded and were used to estimate inter-examiner reproducibility using ICC.
- ❑ Polarized Light Microscopy was used to histologically confirm the presence or absence of a caries lesion on each examined site.

Results

Representative Smooth Surface Scan

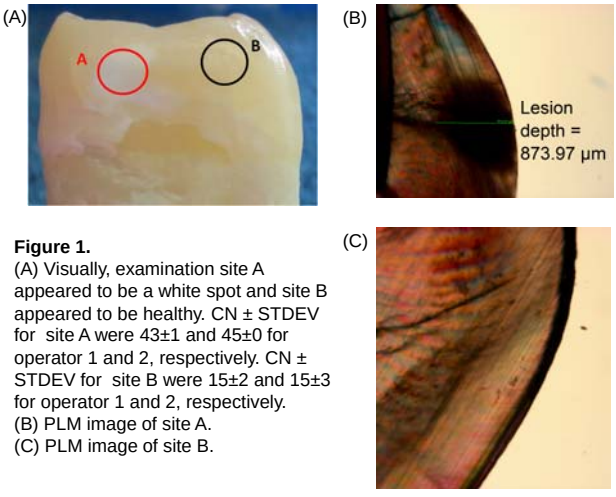


Figure 1.
(A) Visually, examination site A appeared to be a white spot and site B appeared to be healthy. CN ± STDEV for site A were 43±1 and 45±0 for operator 1 and 2, respectively. CN ± STDEV for site B were 15±2 and 15±3 for operator 1 and 2, respectively.
(B) PLM image of site A.
(C) PLM image of site B.

Representative Occlusal Surface Scan

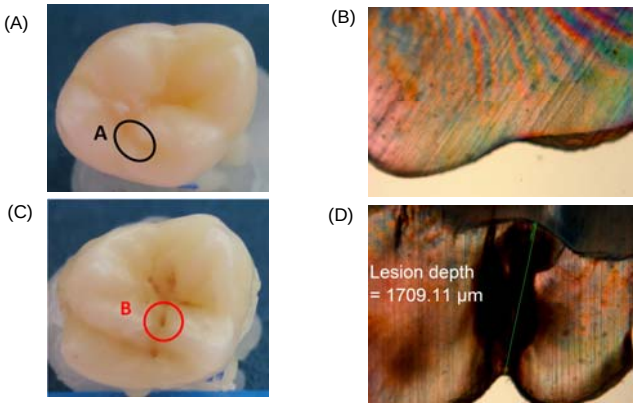


Figure 2. (A) Visually, examination site A appeared to be a healthy fissure. CN ± STDEV for site A was 14±2 for both operator 1 and 2. (B) PLM image of site A. (C) Visually, site B appeared to be an early carious fissure. CN ± STDEV for site B were 44±3 and 48±3 for operator 1 and 2, respectively.
(D) PLM image of site B.

Table 1. Inter- and intra-examiner reproducibility of The Canary System for smooth and occlusal surfaces.

Tooth Surface	Intra-class correlation coefficient (ICC)		
	Intra-examiner reproducibility		Inter-examiner reproducibility
	Operator 1	Operator 2	
Smooth	0.995	0.989	0.929
Occlusal	0.985	0.971	0.853

Discussions and Conclusions

- ❑ For both smooth and occlusal surfaces, The Canary System demonstrated almost perfect intra-examiner reproducibility for both operators (ICC = 0.971-0.995).
- ❑ Inter-examiner reproducibility was higher for smooth surfaces (ICC = 0.929) than for occlusal surfaces (ICC = 0.853) most likely due to greater variability in the anatomic characteristics of the pits and fissures compared to smooth surfaces.
- ❑ Overall, this study demonstrated the ability of The Canary System to detect caries on smooth and occlusal surfaces with excellent intra- and inter-examiner reproducibility.