

Factors Influencing The Use Of The Canary System™ To Detect Early Caries Lesions



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OBJECTIVE

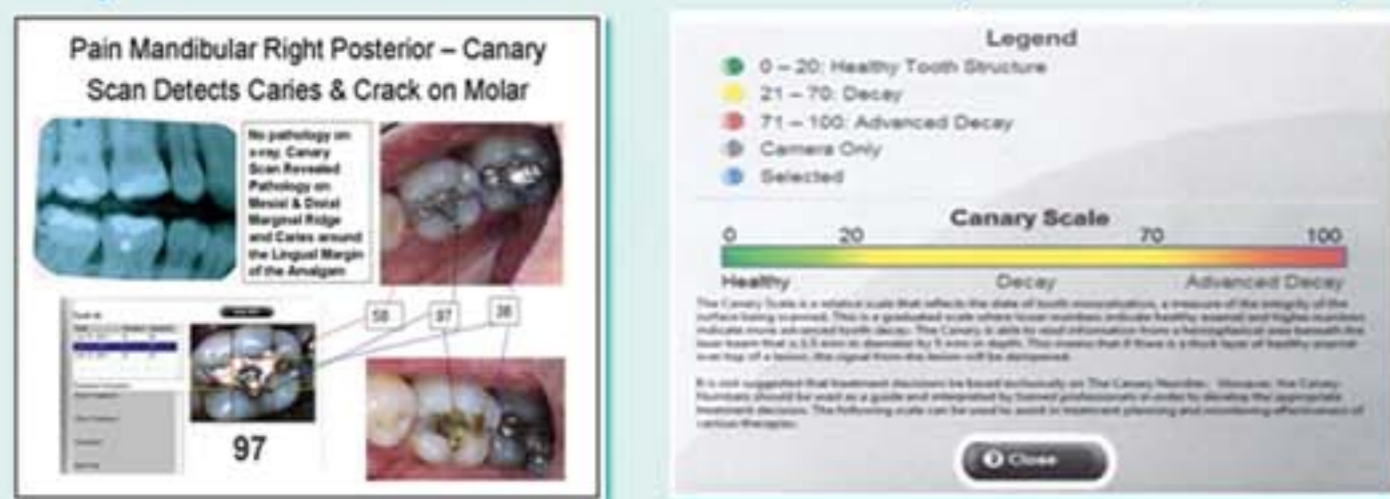
To investigate the influence of lesion staining, presence of moisture, presence of dental plaque and distance of probe tip from the lesion surface, on the readings of The Canary System on both occlusal and smooth tooth surfaces

INTRODUCTION

The Canary System measures the level of glow (luminescence or LUM) and heat (Photo-Thermal Radiometry or PTR) released from the tooth (Abrams, 2011). The Canary System can detect decay on smooth, occlusal, proximal and root surfaces of the teeth as well as around existing amalgam or composite



The clinical trial of The Canary System supported by The Health Technology Exchange reported that The Canary™ System is safe and discriminates between healthy and carious enamel with little or no tooth preparation. The manufacturer claimed the device is a pain free, non-invasive diagnostic that does not require isolation or dry field, and that it is not affected by stain or calculus, and has greater specificity than other devices on the market (Mandelis, 2011).



METHODOLOGY

40 extracted human teeth with caries lesions in varying stages of development were selected, numbered, and mounted individually onto Lego bricks. First 20 teeth have occlusal lesions and the other 20 have smooth surface lesions.

To ensure taking readings from same spot, once a tooth is placed on the platform of the jack as shown in Figure 1, all measurements are carried out before the tooth is removed.

Moisture

The lesion-bearing teeth were submerged in water at room temperature for two hours to allow water to enter the pores in the caries lesion. One tooth at a time was taken out of the water, quickly shaken to remove excess water, and stuck onto a double-sided strip of tape on the platform of the mounting Jack and tested in the following order.

- 1st: While the tooth was wet with water, the lesions were scanned.
- 2nd: Surface with the lesion was dried with an air-syringe for 10 seconds then scanned.

Distance of the Optical Tip

The lesion was then scanned with the device's optical tip at distances of 1, 2, 3, 4, and 5 mm from the lesion surface. The optical tip of the probe was perpendicular to the lesion surface on each case. Once all the teeth were individually tested for moisture and distance, the teeth were immersed in ethanol for 1.5 hours for cold sterilization.

Bacteria Plaque

The lesion-bearing teeth were placed in Streptococcus mutans culture of 107 CFU/ml in 10ml. Cultures were incubated at 37°C for 70 hours. The plaque-covered lesions were scanned using The Canary System (fig. 2).

Staining

Following sterilization of the teeth with ethylene oxide, the teeth were incubated in 2 Liters of Colombian coffee for 72 hours at room temperature. The teeth were air-dried for 10 seconds with an air-syringe to eliminate moisture in the lesion pores, and then scanned.



Fig 1: The experiment apparatus



Fig 2: Bacteria plaque. Smooth surface lesions mounted horizontally and occlusal surface lesions mounted vertically

RESULTS

Condition of Examination	Overall (all surfaces)	Comparison with Dry recommended condition	Occlusal surfaces	Comparison with Dry recommended condition	Smooth surfaces	Comparison with Dry recommended condition
Dry tooth surface (recommended usage condition)	41.25 ±17.2		39.300 ±20.576		43.200 ±13.348	
Wet	28.63 ±16.0	Significant	17.35 ±9.98	Significant	39.90 ±12.7	Not significant
Plaque	47.15 ±16.3	Not significant	47.65 ±19.37	Not significant	46.65 ±12.91	Not significant
Stain	71.93 ±21.9	Significant	78.15 ±24.84	Significant	65.70 ±16.89	Significant
1 mm	45.20 ±21.8	Not significant	46.65 ±28.94	Not significant	43.75 ±11.74	Not significant
2 mm	48.08 ±21.5	Not significant	52.40 ±25.68	Not significant	43.75 ±15.74	Not significant
3 mm	48.15 ±18.5	Not significant	47.55 ±21.88	Not significant	48.75 ±14.81	Not significant
4 mm	46.72 ±18.6	Not significant	47.80 ±23.49	Not significant	45.65 ±12.50	Not significant
5 mm	39.15 ±17.7	Not significant	32.70 ±16.06	Not significant	45.60 ±17.34	Not significant

CONCLUSION AND CLINICAL SIGNIFICANCE

1. The Canary System is capable of detecting and monitoring tooth decay irrespective of the distance of the optical tip (1mm to 5 mm) from the lesion surface and the presence of bacterial plaque on the lesion surface.
2. Lesion staining can have an adverse effect for caries assessment on any tooth surface. Thus it may be necessary for a different cut-off point for decay to be determined for stained decays.
3. The presence of moisture may be a problem only on the occlusal but not the smooth surfaces. However, it may be necessary that for accurate assessment of tooth decay using Canary system, the manufacturer's instruction of drying the tooth before scanning needs to be adhered to, especially on the occlusal surface.