

Int Poster J Dent Oral Med 2005, Vol 7 No 01, Poster 258

## Chemiluminescence and LED: The Future of Early Oral Cancer Detection?

**Language:** English

**Authors:**

Dr. Ram Saravanan, Prof. Dr. Chong Huat Siar,  
Department of Oral Pathology, Oral Medicine and Periodontology,  
Faculty of Dentistry,  
University of Malaya

**Date/Event/Venue:**

07.08.2003 to 09.08.2003  
Science and Technology Exposition 2003  
Putra World Trade Centre, Kuala Lumpur, Malaysia

Poster Award  
Merit Award

### Introduction

The five-year survival rate for oral cancer patients remains unchanged at 50%, and 70% of oral carcinomas present at an advanced T3 or T4 stage. The early detection of primary oral cancer, second primaries or recurrent cancer is important for improving the survival rates. Advancements in cancer research have led to the innovation of contemporary diagnostic tools for early oral cancer detection. Vizilite® and Glowsticks based on the principle of 'chemiluminescence' and Light Emitting Diodes (LED) are the latest diagnostic tools available for this purpose.

### Objectives

- The aim of this study was to evaluate the potential value of chemiluminescence (Vizilite® and Glowsticks) and LED as tools for the early detection of oral cancer, dysplasia and potentially malignant oral lesions.
- The efficacy of these tools was assessed in terms of sensitivity, specificity and accuracy.

### Material and Methods

**Inclusion criteria:**

- Age of subject > 35 years.
- History of habits (smoker, alcoholic, betel quid chewer).
- Subjects with oral lesions i.e. primary squamous cell carcinomas (SCC), previously treated SCC and potentially malignant epithelial lesions (PMEL).

**Methodology: (Figs. A - L)**

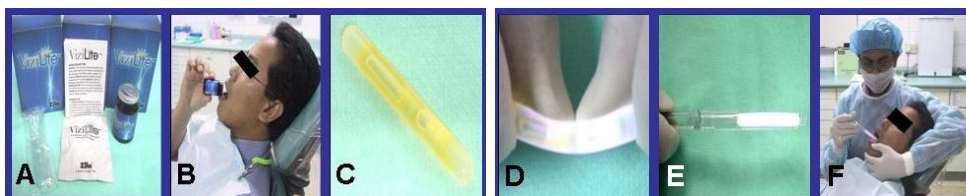
- A total of 67 subjects were evaluated.
- For all subjects, a routine examination of the oral cavity was performed.

**Phase I: (40 subjects)**

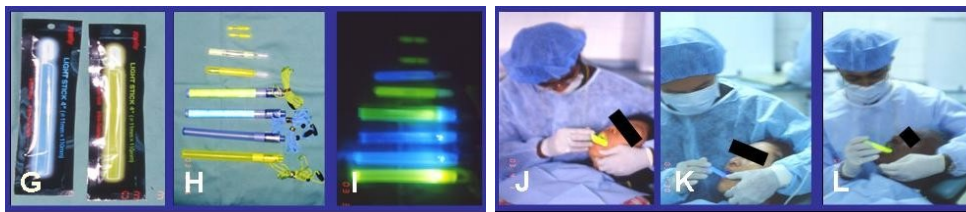
- A 1% acetic acid mouth rinse (30 ml) for 1 min to remove excess saliva, debris and glycoproteins.
- An examination of oral cavity with the bluish white chemiluminescent light or Vizilite®.

**Phase II: (27 subjects)**

- A 1% acetic acid mouth rinse (10 ml) for 1 min.
- An examination of the oral cavity with the yellow and blue chemiluminescent Glowsticks.
- All findings were recorded and photographed.
- All lesions whether positive or negative with Vizilite®. Glowsticks and LED were biopsied.
- Tissue samples were processed and stained with haematoxylin and eosin for microscopic examination blind.



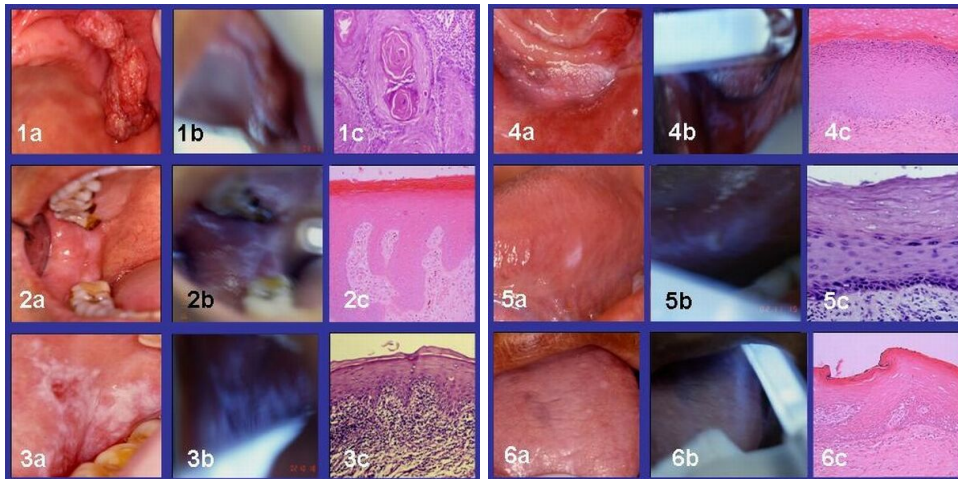
Figs. (A-F): Phase I: Oral Cancer Screening Procedure using Vizilite®



Figs. (G-L): Phase II: Oral Cancer Screening Procedure using Glowsticks and LED

## Results

Biopsies were performed on identified lesions in 37 subjects. Another 14 subjects had no lesions. In the remaining 16 subjects, a biopsy was not performed due to subject's ill-health. The biopsy results were correlated with the clinical observations and the sensitivity, specificity and accuracy were calculated.

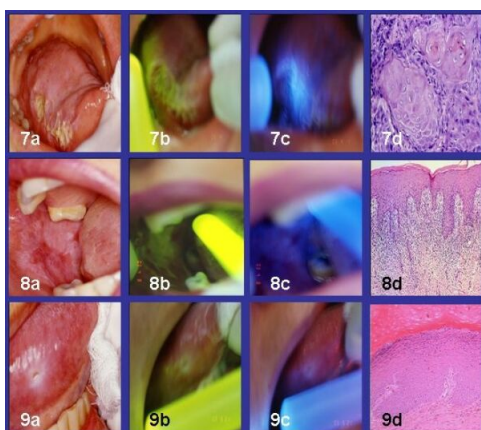


Case Studies(1-3): Vizilite® Histopathology Case Studies(4-6): Vizilite® Histopathology

The results of the study are as follows:

Diagnostic Tools (n)	Sensitivity (%)	Specificity (%)	Accuracy (%)
<b>Vizilite®</b>	32 100	85,7	96,8
<b>Glowsticks</b>	19 100	90	95
<b>LED</b>	19 100	90	95

(n) - Number of cases, (%) - Percentage.



Case Studies(7-9): Glowsticks LED Histopathology

## Discussion

Vizilite® is expensive and can be used only for a single patient as the light lasts for 10 minutes. In our endeavour to find a cheaper alternative that could be used as an effective mass screening tool for high-risk individuals, we innovatively improvised Glowsticks and LEDs for this purpose. The light produced by Glowsticks lasts for a longer period of time (3 days) than Vizilite®. However, the LEDs are battery operated devices that produce a light of higher intensity than the other two tools, is more cost effective and can be chemically sterilized and used for screening numerous patients at one time. All three tools showed a sensitivity of 100% indicating no false negative findings. There were fewer false positive findings with the Glowsticks and LEDs and therefore their specificity is marginally greater than for Vizilite®. The overall accuracy is marginally greater for Vizilite® as the study sample evaluated is larger than for the other two tools. Although all three tools seem to be equally effective in the identification of early neoplastic and dysplastic changes, differences exist in terms of cost effectiveness, duration of use, and usage on multiple patients.

## **Conclusion**

Chemiluminescence and LED are equally effective in the early detection of oral cancer, dysplasia and PMEL. The LED may prove to be a cheap, safe and non-invasive tool for screening high-risk individuals in clinics, health centres and remote areas devoid of modern healthcare facilities.

## **Acknowledgements**

We thank the staff of the Departments of Oral Pathology, Oral Medicine & Periodontology, and Oral & Maxillofacial Surgery, Faculty of Dentistry, University of Malaya for their invaluable assistance. This study was funded by a Vote F grant F0105/2002D from the University of Malaya. [Ethics approval No.DFOP0202/002(P)]

## **Literature**

1. Porter SR, Scully C. Early detection of oral cancer in the practice. BDJ 1998 Jul; 185(2): 72-73.
2. Carlson R, Lewis SW, Lim KF. Seeing the light: Using chemiluminescence to demonstrate chemical fundamentals. Chemedica: Aust J Chem Ed 1999, 14: 51-53.
3. Eckert SE, Goldstein GR, Koka K. How to evaluate a diagnostic test. J Prosthetic Dentistry 2000, Apr; 83(4): 386-91.

*This poster was submitted by Dr. Saravanan Ram.*

## **Correspondence address:**

*Dr. Saravanan Ram*

Department of Oral Pathology, Oral Medicine and Periodontology  
Faculty of Dentistry  
University of Malaya  
Kuala Lumpur, Malaysia



# Chemiluminescence and LED: The Future of Early Oral Cancer Detection?

SARAVANAN R\* and SIAR C H

Department of Oral Pathology, Oral Medicine and Periodontology,  
Faculty of Dentistry, University of Malaya, Kuala Lumpur, Malaysia.



## Introduction

The five-year survival rate for oral cancer patients remains unchanged at 50%, and 70% of oral carcinomas present at an advanced T3 or T4 stage. The early detection of primary oral cancer, second primaries or recurrent cancer is important for improving the survival rates.

Advancements in cancer research have led to the innovation of contemporary diagnostic tools for early oral cancer detection. Vizilite® and Glowsticks based on the principle of 'chemiluminescence' and Light Emitting Diodes (LED) are the latest diagnostic tools available for this purpose.

## Objectives

- ◆ The aim of this study was to evaluate the potential value of chemiluminescence (Vizilite® and Glowsticks) and LED as tools for the early detection of oral cancer, dysplasia and potentially malignant oral lesions.
- ◆ The efficacy of these tools was assessed in terms of sensitivity, specificity and accuracy.

## Materials and Methods

### Inclusion criteria:

- ◆ Age of subject ≥ 35 years.
- ◆ History of habits (smoker, alcoholic, betel quid chewer).
- ◆ Subjects with oral lesions i.e. primary squamous cell carcinomas (SCC), previously treated SCC and potentially malignant epithelial lesions (PMEL).

### Methodology: (Figs. A – L)

- ◆ A total of 67 subjects were evaluated
- ◆ For all subjects, a routine examination of the oral cavity was performed.

### Phase I: (40 subjects)

- ◆ A 1% acetic acid mouth rinse (30 ml) for 1 min to remove excess saliva, debris and glycoproteins.
- ◆ An examination of oral cavity with the bluish white chemiluminescent light or Vizilite®.

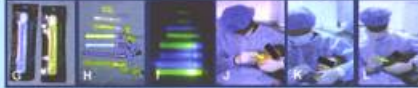
### Phase II: (27 subjects)

- ◆ A 1% acetic acid mouth rinse (10 ml) for 1 min.
- ◆ An examination of the oral cavity with the yellow and blue chemiluminescent Glowsticks.
- ◆ An examination of the oral cavity with the yellow and blue LEDs.
- ◆ All findings were recorded and photographed.
- ◆ All lesions whether positive or negative with Vizilite®, Glowsticks and LED were biopsied.
- ◆ Tissue samples were processed and stained with haematoxylin and eosin for microscopic examination blind.

Figs. (A – F): Phase I: Oral Cancer Screening Procedure using Vizilite®



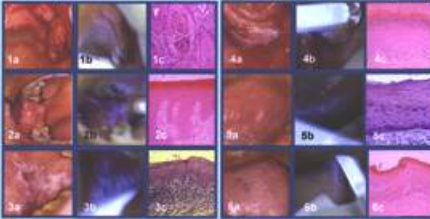
Figs. (G – L): Phase II: Oral Cancer Screening Procedure using Glowsticks and LED



## Results

Biopsies were performed on identified lesions in 37 subjects. Another 14 subjects had no lesions. In the remaining 16 subjects, a biopsy was not performed due to subject's ill-health. The biopsy results were correlated with the clinical observations and the sensitivity, specificity and accuracy were calculated.

Case Studies(1-3): Vizilite® Histopathology Case Studies(4-6): Vizilite® Histopathology

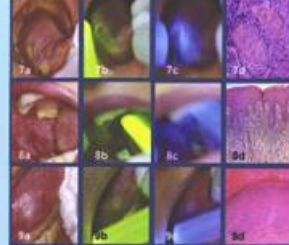


The results of the study are as follows:

Diagnostic Tools	(n)	Sensitivity (%)	Specificity (%)	Accuracy (%)
Vizilite®	32	100	85.7	96.8
Glowsticks	19	100	90	95
LED	19	100	90	95

(n) – Number of cases, (%) – Percentage

Case Studies(7-9): Glowsticks LED Histopathology



## Discussion

Vizilite® is expensive and can be used only for a single patient as the light lasts for 10 minutes. In our endeavour to find a cheaper alternative that could be used as an effective mass screening tool for high-risk individuals, we innovatively improvised Glowsticks and LEDs for this purpose. The light produced by Glowsticks lasts for a longer period of time (3 days) than Vizilite®. However, the LEDs are battery operated devices that produce a light of higher intensity than the other two tools, is more cost effective and can be chemically sterilized and used for screening numerous patients at one time.

All three tools showed a sensitivity of 100% indicating no false negative findings. There were fewer false positive findings with the Glowsticks and LEDs and therefore their specificity is marginally greater than for Vizilite®. The overall accuracy is marginally greater for Vizilite® as the study sample evaluated is larger than for the other two tools.

Although all three tools seem to be equally effective in the identification of early neoplastic and dysplastic changes, differences exist in terms of cost effectiveness, duration of use, and usage on multiple patients.

## Conclusions

Chemiluminescence and LED are equally effective in the early detection of oral cancer, dysplasia and PMEL. The LED may prove to be a cheap, safe and non-invasive tool for screening high-risk individuals in clinics, health centres and remote areas devoid of modern healthcare facilities.

## Acknowledgements

We thank the staff of the Departments of Oral Pathology, Oral Medicine & Periodontology, and Oral & Maxillofacial Surgery, Faculty of Dentistry, University of Malaya for their invaluable assistance. This study was funded by a Vote F grant F0105/2002D from the University of Malaya. [Ethics approval No. DFOPO202/002(P)]

## References

1. Porter SR, Scully C. Early detection of oral cancer in the practice. *BDJ* 1999 Jul; **150**(2): 72-73.
2. Carlson R, Lewis SW, Lim KF. Seeing the light: Using chemiluminescence to demonstrate chemical fundamentals. *ChemEds Aust J Chem Ed* 1999; **14**: 51-53.
3. Ezzart SE, Goldstein GR, Kolia K. How to evaluate a diagnostic test. *J Prosthetic Dentistry* 2000; Apr; **63**(4): 306-91.