

A Fibre Optic System for the Detection of Dental Caries

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The tooth is a biological entity comprising of a hard enamel layer, encasing the softer (but still hard) dentine which conceals the much softer pulp chamber. Dental caries, commonly known as tooth decay, is the localized demineralization of enamel or dentine caused by the acidic by products of bacteria. Current methods of detection and diagnosis routinely used in the dental surgery are limited to the subjective act of visual inspection (with aide of a metal probe known as an explorer) and bitewing X-ray. Neither method provides quantitative information about the state of the disease in the tooth for accurate diagnosis and subsequent treatment planning. Such methods are also poor at detecting disease in the early (and most treatable) stages. There are, however, new

technologies, generally optically based, making their way into the dental clinic, including Quantitative Light Fluorescence and the DiagnoDent tool. Both methods are able to improve the detection rates of dental caries, however, the outputs from these tools are still somewhat subjective and not quantitative, in particular providing no information on the depth of a lesion. We are reporting on work carried out using the technique of Fibre Optic Confocal Microscopy (FOCOM) in order to produce a device which can record depth profiles through the tooth and allow detection and quantification of subsurface lesions. The method has been shown to detect caries lesions and this paper concentrates on the miniaturisation of the tool for use in the oral cavity within the dental clinic. Two types of miniature lenses, GRIN and aspheric, are investigated using a computer simulation followed by experimental verification. The subsequent choice of the latter is then reported in a desktop system in the near infrared to produce depth profiles through extracted teeth with these profiles showing different characteristics between sound enamel and lesioned enamel. Results with the system used to monitor the change in surface reflection from a tooth during acid erosion of the enamel surface. The results from this new diagnostic instrument thus have applicability for both detecting and following caries lesions during a planned treatment programme of remineralization as well as to monitor the effects of acid erosion a growing dental problem caused by the consumption of acidic soft drinks.

Comparison of Video Laryngoscopy Technologies

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Indirect laryngoscopy allows practitioners to “see around the corner” of a patient’s airway during intubation. Inadequate airway management is a major contributor to patient injury, morbidity and mortality. The purpose of the present study was to evaluate the video quality of commercially available video laryngoscopy systems. A team of four investigators at the University of Nebraska at Omaha and the Peter Kiewit Institute performed intubation simulations using a number of video laryngoscopy systems. Testing was done with a Laerdal Difficult Airway Manikin (Laerdal Medical Corp., Wappingers Falls, NY) in a setting that simulated difficult airways, adverse lighting conditions and various system configurations (e.g., maximizing screen contrast, minimizing screen brightness, maximizing screen color hue, etc.). Systems included the STORZ C-MACTM (KARL STORZ Endoscopy, Tuttlingen, Germany), a prototype developed by STORZ (a McIntosh #3 video blade with USB connectivity to an ultra mobile PC; “UMPC”) and a GlideScope[®] Portable GUL (Verathon Inc., Bothell, WA). Equipment was evaluated based on investigator’s perceptions of the color (“C”), clarity (“L”) and brightness (“B”) of

the image onscreen for each of the systems. Perceptions were given one of three possible ratings: High=3, Moderate=2 or Low=1. Statistics were performed using a two-tailed Wilcoxon Rank Sum test for independent samples. A summary of the results of the testing are shown below (shown as “Mean±Standard Deviation”):

- C-MAC-L=2.13±0.99, C=1.75±0.89, B=2.5±0.93, Total=6.38±2.5
- GlideScope[®]-L=2.38±0.92, C=1.38±0.52, B=2.38±0.92, Total=6.13±1.96
- UMPC-L=1.88±0.83, C=1.75±1.04, B=1.88±0.83, Total=5.5±2.2

Testing showed that there were no significant differences between image clarity, color, brightness or overall score of any of the tested systems ($\alpha=0.05$). Since there were no significant differences in video quality between the three systems, the choice of system falls to user preference, which can vary from person to person, and qualitative analysis of features that are outside the scope of this study. Investigators plan to evaluate additional video laryngoscopy solutions in an effort to create a platform-agnostic video laryngoscopy suite. Funding by KARL STORZ Endoscopy. Investigators were blinded to funding source until after testing was completed. The authors wish to thank Dr. W. Bosseau Murray for his insightful comments.