

Auto Fluorescence Allows Us to Detect Early Signs of Oral Cancer and Much More

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Abstract

This paper introduces a novel approach, using autofluorescence, to objectively examine the oral cavity for inflammation and infection. Many systemic diseases are perpetuated by microorganisms that colonize in the oral environment. They enter the cardiovascular system by enzymatic processes that open the oral mucosa to allow their entry. A majority of the microbes are anaerobes and/or facultative anaerobes. When they enter the host, they metabolize blood. Their waste by products contains iron elements within a compound called porphyrin. Porphyrin will fluoresce when exposed to certain wavelengths of light. Healthcare providers can utilize this natural occurring process to objectively see these harmful pathogens. This may indicate that the host has a Sleep Related Breathing Disorder (SRBD). Sleep apnea is a primary disorder of SRBD's. This technology offers medical and dental fields a screening tool for a pandemic healthcare problem.

Keywords: Autofluorescence; Velscope; Porphyrin; Anaerobes.

Introduction

The great scientist, Albert Szent-Gyorgi credited for discovering Vitamin C, once stated "the trick is to see what others see but to think what others do not think". As we accelerate into the world of digital technology, the discovery and acknowledgement of the electromagnetic spectrum of light to enhance our diagnostic abilities for early detection of diseases is becoming vitally important [1]. In the 2000's

Velscope and other LED technology became recognized in the medical and dental communities as a tool to screen for early physiologic signs of oral cancer [2].

Discussion

Velscope has become the most prevalent FDA recognized tool for early detection of oral cancer. Velscope utilizes the concept of autofluorescence (AF) to allow the

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examiner to visualize physiologic parameters within the oral mucosa. Histopathologic comparison to fluorescent findings, in research support, a high rate of sensitivity for “early detection” of cellular metabolic activity. This may indicate the presence of pathologic conditions [3]. These pathologic conditions, that originate from the cell’s powerhouse, the mitochondria, reveal metabolic activity that may represent inflammation, abnormal cellular proliferation and ultimately genetic mutagenesis that result in oral cancer [4]. One cannot diagnose oral cancer with findings from Velscope alone. Velscope can be a powerful ally to healthcare practitioners as a diagnostic adjunct for detection of pathologic presentations, that can be easily overlooked. AF of the oral mucosa with technology like Velscope offers other diagnostic innovations that are related to spectral absorption. They are equally important as illuminating abnormal cellular metabolic activity [5]. Using LED light in the 400-460nm visible light spectrum, with special filters (Velscope), can cause certain microbes (bacteria, viruses, and fungi) to fluoresce [6]. The fluorescence is caused by excitation of porphyrin molecules found within most living things. Porphyrin molecules, which are essential compounds of metabolic respiratory functions and are functional units within humans that compose the heme portion of blood [7]. Hemes are important components of oxygen transportation. They will fluoresce (red-orange) when exposed to various wavelengths of the electromagnetic spectrum of light. Pathogenic microbes ingest blood for their food source. They metabolize blood and their waste is composed of porphyrin byproducts. They mark themselves with porphyrin. Their

waste allows a noninvasive “birds eye view” of their presence [8]. Using Velscope to expose these pathogenic microorganisms to the blue portion of the visible light electromagnetic spectrum will cause (red-orange) fluorescence to occur. The examiner can see the (red-orange) presentation that microbes are colonizing. This visual process is an effective means to visualize microbes. This biological process can give scientists a relative understanding of the microbial bioload [9]. After performing over 10,000 oral examinations with the Velscope, there were some confounding recurring findings. Analysis of empirical statistics unveiled approximately 70 % of the patient examinations revealed the presence of porphyrin (red-orange). Research has validated that these findings are an indication of anaerobic and facultative anaerobic microbes. Approximately 30% of the examinations demonstrated no significant evidence of porphyrin. At this time, in the history of oral healthcare, little importance has been given to these ubiquitous findings [10-11]. The challenge is for healthcare providers that the evidence of porphyrin (representing microbial metabolites) in the oral cavity has relevance. These findings are equally as important as the visual presentation of total absorption of the light that may be oral cancer. A novel approach to objectively observe microbial infection of the oral mucosa with Velscope, and other LED technologies of similar functionality, have been openly criticized for their lack of specificity [12]. No disputes have been posed for the sensitivity of this technology for AF of cellular activity that indicate hyperactivity within the metabolic epicenter, the mitochondria [13]. These concerns are focused on the detection of oral cancer. The push back for gold standard

acceptance is the decry “There is a high rate of false positives observed by healthcare practitioners with the AF expressions they suspect to be oral cancer”. This may have validity if oral cancer is the only pathologic condition that is being screened for. Firm diagnosis of oral cancer can be confirmed only with histologic examination. There is little dispute that the objectification of

erratic, hyper metabolic activity within the mitochondria represents pathogenic processes. These processes are agreed upon, by most researchers, to be an expression of inflammation and/or dysplasia. It is further agreed that a continuum from inflammation to dysplasia to mutagenic changes can result in cancer, including oral cancer [14].

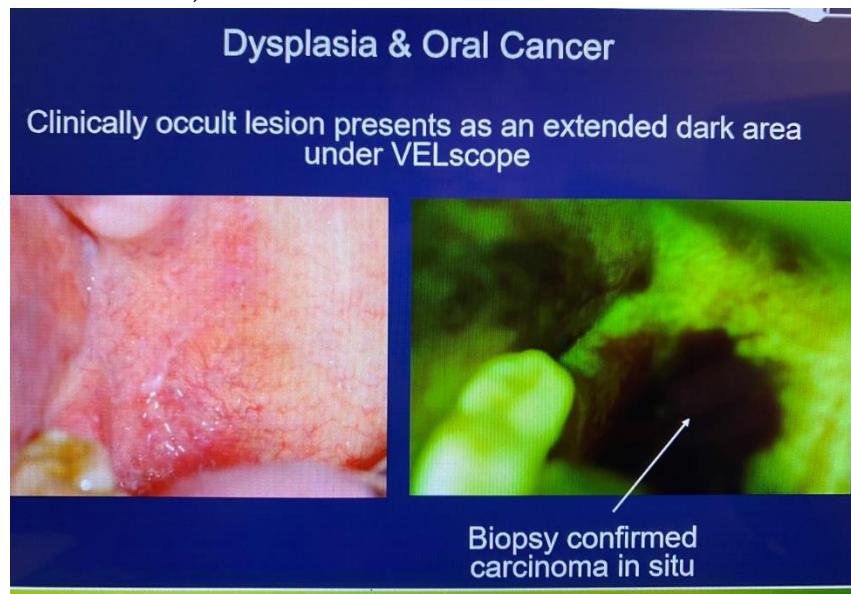


Figure 1: The Velscope AF expression of a lesion that is oral cancer.

It is beyond the scope of this paper to discuss florescence of inflammation, dysplasia and oral cancer. It is enough to point out that the FDA has approved this LED technology (Velscope) for objective visualization of these metabolic pathogenic processes [15]. It is well accepted in medicine and dentistry that inflammation can be a deadly disease. To be able to noninvasively see inflammation or dysplasia, recognized as dynamic, progressive pathogenic processes of the body, can be valuable. In the spirit of Christopher Columbus, a new land has been exposed to healthcare through auto fluorescence. Recent research with AF has exposed an ecosystem that is right before our eyes. Research published in March 2020 by Wilbert, et al. revealed the bacterial

inhabitation of the dorsum of the tongue [16]. Utilizing AF techniques and genetic vetting of the dorsum of the tongue, most of the pathogens within the oral cavity thought to be primarily from the periodontal pocket ecosystem, can also inhabit the dorsum of the tongue. These pathogens, such as *Porphyromonas gingivalis* (Pg), *Aggregatibacter actinomycetemcomitans* (Aa) and *Fusobacterium nucleatum* (Fn) are anerobic or facultative anerobic bacteria. Further research uncovered their metabolic mechanisms that allow them to slip between the first line protective mucosal epithelial cells into the blood stream, virtually undetected [17]. Most likely, in smaller amounts of bioload these pathogens can exist within the commensal

communities they cohabitate. Although, in their desire to multiply they search for more bountiful food sources of glucose. These microbes use their enzymatic ability to breach the “gates of Troy”, the epithelial cells of the tongue and oral mucosa. Research demonstrates these pathogens use their “trojan horse” capabilities to enter the hosts cardiovascular system [17]. At the

moment this occurs it is a **Bacterial Infection**. These bacterial infections are most prevalent on the posterior dorsum of the tongue. They can be objectively visualized with LED technology emitting 400-460nm with special filters (Velscope) [18]. Their visual expression is in the (red-orange) portion of the electromagnetic spectrum.

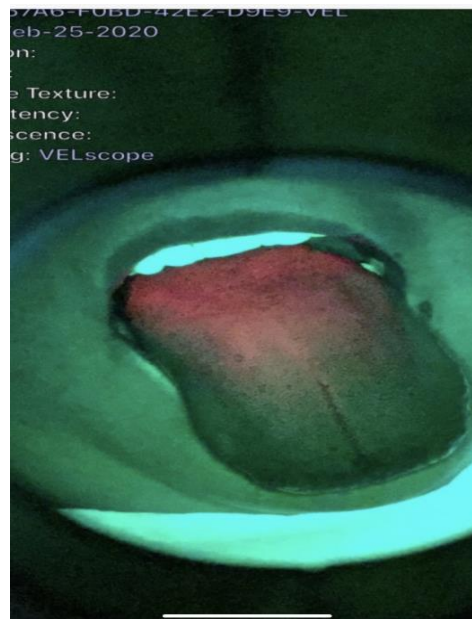


Figure 2: A bacterial infection on the dorsum of the tongue.

The pathogens (Pg, Aa, and Fn) require a low or no oxygen environment to thrive. Accepting this fundamental law of microbiology, we must question the oxygen prevalence of the newly recognized ecosystem, the dorsum of the tongue. One possible answer is: Increase in the bioload of these pathogens is indicative that the host has periods of time when the oxygen levels decrease surrounding certain areas of the tongue. The decrease in the oxygen concentration allows colonization of anaerobic and facultative anaerobic microbes. From AF research on point of care visualization of similar pathogens within diabetic wounds of the foot, we can infer the same processes occur within the oral

mucosa [19]. Pathogenic microbial presences and the size of the colony (the bioload) can be relatively determined [19]. AF visualization of (red-orange) means anaerobic or facultative anaerobic bacteria are present. The larger the number of pathogens colonizing an area reveal a visual presentation of brighter fluorescence. The conditions for these pathogens to exist can occur within individuals with Sleep Related Breathing Disorders (SRBD). Sleep Apnea is the most prevalent of these disorders [20]. Researchers should focus their attention to the dorsum of the tongue ecosystem. Autofluorescence, performed with technology that utilizes electromagnetic spectral ranges and special filters that are

components of the Velscope, allows visualization of pathogenic microbes. Scientific research demonstrates that oral pathogens (Pg, Aa, and Fn) may be direct and/or indirect causative agents of systemic diseases. These oral pathogens cause inflammation and infection [21-23].

Conclusion

Now, with these resources we can observe these expressions of disease. Being able to visualize pathology we can develop a better understanding of health. More research must be done with this exciting new information. Potential positive impacts on healthcare are at our gates. Let us open our gates, our minds, and engage the enemies.

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