Sci Forschen
International Journal of Dentistry and Oral Health
ISSN 2378-7090 | Open Access

EDITORIAL

Volume 9 - Issue 1

Shine the Light, and Find the Path!

Anusha Vaddi*

School of Dentistry, Department of Oral Diagnostic Sciences, Virginia Commonwealth University, Richmond, Virginia, USA

***Corresponding author:** Anusha Vaddi, Assistant Professor, School of Dentistry, Department of Oral Diagnostic Sciences, Virginia Commonwealth University, Richmond, Virginia, USA, E-mail: vaddia@vcu.edu

Received: 04 Mar, 2023 | **Accepted:** 18 Mar, 2023 | **Published:** 24 Mar, 2023

Citation: Vaddi A (2023) Shine the Light, and Find the Path! Int J Dent Oral Health 9(1): dx.doi.org/10.16966/2378-7090.404

What if there was a way to determine the extent of caries without using X-rays? What if there was a minimally-invasive way to understand and detect early demineralization changes occurring in the dental hard tissues?

Light is a form of electromagnetic radiation. In the electromagnetic spectrum, based on wavelength, light is broadly classified as Ultraviolet (UV) light (170-380nm), visible (380-780nm), and infrared (IR) light (780-3300nm). Since the 19th century physicians were using different forms of light to treat various diseases. Because of its non-invasive nature and capability to acquire high-resolution images, there was a lot of interest to extend the applications of light in diagnostic imaging. The potential applications of optical imaging have been increasing with the advent of Lasers (light amplification by stimulated emission of radiation) and other optical devices.

A wide variety of optical instruments have been employed in medicine. Optical coherence tomography (OCT) is used to obtain high-resolution images of the cornea and retina of the eye and to diagnose ocular pathologies. Confocal laser endomicroscopy (CLE) has diagnostic applications in gastrointestinal diseases such as polyps, inflammatory bowel disease, and some malignant diseases. Photoacoustic imaging coupled with Ultrasound transducers has shown a promising role in detecting circulating tumor cells in rodents [1].

Innovations in technology have led to the use of light-based modalities in dentistry. Light in the IR range can penetrate the enamel, dentin, and pulp. The optical properties of enamel and dentin are disrupted in dental disease. Due to this, changes in mineralization can be detected using optical devices.

Previous research was focused on investigating the potential value of light-based methods such as Quantitative light-induced fluorescence (QLF), fiber optic Transillumination (FOTI) using visual light, DIAGNOdent using laser light in the detection of early caries and cracks. The limitation of these devices is their sensitivity to the external light which impacts the image quality. None of these devices were widely employed in clinical practice [2].

Some investigators focused on the detection of dental caries by OCT. OCT is an infra-red light-based imaging modality that generates cross-sectional images based on the magnitude of backscattered light. Few studies have shown the potential role of Swept Source OCT(SS-OCT) in the detection of incipient caries and determining the extent of microfractures. The limitation of OCT is it can determine tissue characteristics only at the sub-surface level. Also, occlusal topography influences the depth of light penetration in OCT [3].

Spectroscopic techniques such as Raman, and Near Infra-Red (NIR) help in the qualitative analysis of the sample. They have the potential to detect early demineralization changes. Raman spectroscopy has proven to have high sensitivity in analyzing variations in mineral content in tooth enamel. Few studies showed the role of Raman in diagnosing incipient carious lesions that were not detected during a clinical examination. The limitations of Raman Spectroscopy are its shallow depth of penetration, the high cost of the device, the inherent weakness of the Raman signal, and fluorescence [4]. Spatial frequency domain imaging (SFDI) is another modality that uses light at different spatial frequencies to detect caries. In a recent study by Bounds and Girkin SFDI has shown a promising role in detecting early demineralization changes [5].

The advantages of light-based imaging modalities are, they are minimally invasive, easy to use, and provide real time analysis. Also, they can be used regularly for periodic follow-up.

The usage of Optical devices in diagnosing carious lesions is a rapidly progressing field. Many of the optical devices are being tested in the laboratory, or in *ex-vivo* studies, only a very few of them were tested clinically. Even those tested clinically are not considered first-line diagnostic tools. Future research should be directed toward developing a dedicated optical tool for intraoral assessment that has high sensitivity and specificity to detect early demineralization changes.

References

1. Yun SH, Kwok SJ (2017) Light in diagnosis, therapy and surgery. Nat Biomed Eng.
2. Oh SH, Choi JY, Kim SH (2022) Evaluation of dental caries detection with quantitative light-induced fluorescence in comparison to different field of view devices. Sci Rep 12: 6139.

3. Shimada Y, Yoshiyama M, Tagami J, Sumi Y (2020) Evaluation of dental caries, tooth crack, and age-related changes in tooth structure using optical coherence tomography. Jpn Dent Sci Rev 56: 109-118.

4. Yakubu E, Li B, Duan Y, Yang S (2018) Full-scale Raman imaging for dental caries detection. Biomed Opt Express 9: 6009-6016.

5. Bounds AD, Girkin JM (2021) Early stage dental caries detection using near infrared spatial frequency domain imaging. Sci Rep 11: 2433.