SKIN CANCER (OTHER THAN MELANOMA)

REAL TIME, IN VIVO SKIN CANCER DIAGNOSTICS BASED ON LASER SPECTROSCOPY AND AI-BASED ALGORITHMS USING AESTHETIC LASERS

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Introduction and Objective: There have been several in vivo skin cancer screening techniques, such as multi-spectral imaging and Raman spectroscopy. However, some of them implement high-cost lasers or imaging sources and have insufficient diagnostic accuracies for clinical use. We developed a real time, in vivo skin cancer diagnostic device with high diagnostic accuracy based on non-discrete molecular laser induced breakdown spectroscopy (LIBS) and deep neural network (DNN) utilizing pre-existing aesthetic lasers as its excitation sources.

Materials and Methods: A single-site study was designed to evaluate the effectiveness and safety of the device. The device consists of the light collection module attached to a handpiece and the analysis module mounted on any kind of short-pulsed (picosecond to nanosecond) laser system. A Q-switched (QS) 1064nm laser was used to induce the micro plasma from the suspicious skin lesion. The analysis module of the device analyzes the plasma light spectrally to extract the elemental and molecular information from the skin lesion. We collected total 656 emission spectra from 136 skin cancers confirmed with biopsy results and total 2052 emission spectra from 446 benign lesions.

Results: A DNN was trained with the randomly selected 75% of the total spectral data sets to construct the classification model or the diagnostic algorithm. The diagnostic algorithm analyzes the remaining 25% of the total data and determines the similarity to the trained spectral database, implying the probability of malignancy. In this study, the DNN-based diagnostic algorithm achieved averaged sensitivity of 91% and specificity of 86% for the detection of skin malignancy from multiple validation tests in blind setting.

Conclusions: A novel skin cancer diagnostic device based on non-discrete molecular LIBS and deep learning-based diagnostic algorithms demonstrated to be a promising, low-cost tool for the detection of skin cancers with superior diagnostic accuracy compared to other optics-based diagnostic techniques.