

# Noninvasive Optical Technologies for Wound Imaging

Afshan Shirkavand <sup>1,2</sup>, Fazel Jahangiri <sup>2</sup>, Ezeddin Mohajerani <sup>2</sup>

*1. Researcher of Medical Laser Research Center, ACECR, Tehran, Iran*

*2. Laser and Plasma Institute, Shahid Beheshti University (SBU), Tehran, Iran*

Corresponding Author: Afshan Shirkavand, E-mail: afshan\_shirkavand@yahoo.com

## ABSTRACT

Noninvasive imaging approaches can provide greater information about a wound than visual inspection during the wound healing and treatment process. Here we would like to focus on various noninvasive optical imaging techniques developed to image different wound especially superficial types.

The noninvasive optical imaging techniques include imaging methods including laser Doppler imaging (LDI), optical coherence tomography (OCT), laser speckle imaging (LSI), Terahertz imaging, optical spectroscopy methods like Near-infrared spectroscopy (NIRS), and other complicated ones. The various wounds may image using these techniques include open wounds, chronic wounds, diabetic foot ulcers, and more importantly burns. Preliminary work in the development and implementation of some technologies has demonstrated its potency to differentiate a healing from nonhealing of a wound and assessment depth, dimensions and severity.

A crisis of most of the optical imaging techniques is regarded as limited penetration of light in tissue, few hundred microns to a 1–2 mm from the skin surface, NIRS has the potential to penetrate deeper, demonstrating the potential to image internal wounds.

In addition, by introducing Terahertz nondestructive techniques, using the terahertz domain of electromagnetic radiation (1 THz =  $10^{12}$  Hz, wavelength: 1 mm to 0.1 mm), based on main interaction of THz waves with water, we are able have accurate monitoring of burns since the burn lesions have different water contents compare to normal tissue.

In summary, most technologies are currently at various stages of translational efforts to the clinic, while NIRS or THz holding a greater promise for physiological assessment of the wounds internal, beyond the gold-standard visual assessment.