Assessment Of Wound Status And Tissue Viability Via Analysis Of Spatially Resolved Thz Reflectometry Maps

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SUMMARY

UCLA researchers in the Department of Bioengineering have developed an algorithm to assess the burn wound severity and predict its future outcomes using Terahertz imaging.

BACKGROUND

Quantitatively assessing burn wound severity and predicting how the wound heals is important for timely and accelerated therapeutic interventions. However, currently available imaging techniques have limited capabilities to perform such an analysis. Optical coherence tomography is only limited to assessing the morphological features of the wound, while assessing wound severity through Doppler processing of coherent laser illumination is confounded by the presence of edema in the wound tissue. Terahertz imaging has been shown to be a promising technique for assessing the burn wound status due to its high sensitivity and specificity to tissue water content. However, currently there is no technique that can spatially delineate different regions within the burn tissue and determine the future outcomes of the wound.

INNOVATION

Dr. Zachary Taylor and colleagues have developed an algorithm that can process terahertz images to assess skin-burn wound status and spatially delineate different regions within the wound as the regions that will heal, regions that require intervention, and regions that are permanently damaged. The algorithm exploits the high contrast sensitivity of terahertz reflectivity maps to differential edema distribution in an acute wound to spatially delineate the wound status. The algorithm's spatial diagnosis can be co-registered with a visible image to facilitate clinical decision-making. Unlike other imaging techniques, the algorithm is robust to the presence of edema and tissue swelling in acute burn injuries.

APPLICATIONS

The proposed algorithm can be potentially applied to spatially delineate different regions in the skin-burn wounds based on the severity of the wound and wound healing status. It can be potentially extended to assessing skin wounds in other pathologies including:

- Skin cancer
- Pressure ulcers
- Diabetic ulcers
- Arterial/Venous insufficiency ulcers
- Dermatitis
- Acne
- Bacterial skin infections
- Surgical wounds

ADVANTAGES

- Ability to spatially delineate different regions in a wound based on the wound severity and future outcomes of the wound
- Robust to the presence of edema and tissue swelling in the acute stages of wound progression

STATE OF DEVELOPMENT

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OTHER INFORMATION

KEYWORDS

Terahertz, Wound, Burn, Skin, Algorithm

CATEGORIZED AS

- **Imaging**
  - Medical
  - Software
- **Medical**
  - Disease: Dermatology
  - Imaging
  - Software

RELATED CASES

2015-149-0

A working algorithm exists. The algorithm has been successfully tested in rats to differentiate partial thickness burns from full thickness burns.

Results from the algorithm have been validated using histology.

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	11,660,012	05/30/2023	2015-149

RELATED MATERIALS

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- Tewari, P. Kealey, C. P., Bennett, D. B., Bajwa, N. Barnett, K. S., Singh, R. S., Culjat, M. O., Stojadinovic, A., Grundfest, W. S., Taylor, Z. D. In-vivo terahertz imaging of rat skin burns. Journal of Biomedical Optics, 2012, 17(4): 040503

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Scanning Method For Uniform, Normal-Incidence Imaging Of Spherical Surface With A Single Beam
- Simultaneous Corneal Hydration Thickness And Hydration Measurement Through Multi-Spectral Reflectometry

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