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Tirbanibulin treatment for Actinic Keratosis: LC-OCT with AI-based algorithm evaluation

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Introduction & Objectives:

Actinic keratosis (AK) is a prevalent precancerous skin condition primarily caused by prolonged exposure to ultraviolet (UV) radiation, most commonly affecting individuals with fair skin. It typically presents as rough, scaly patches on areas frequently exposed to the sun and carries a risk of progressing to invasive squamous cell carcinoma (SCC). Early identification and timely intervention are crucial to preventing malignant transformation. In recent years, non-invasive imaging technologies such as Line-field Confocal Optical Coherence Tomography (LC-OCT) have become valuable tools for real-time, in vivo assessment of skin lesions. LC-OCT combines the cellular resolution of confocal microscopy with the depth penetration of optical coherence tomography, allowing for high-resolution visualization of both the epidermis and dermis. This enables accurate diagnosis and monitoring of AK without the need for invasive biopsies. Tirbanibulin, a novel topical agent approved for the treatment of AK, works by inhibiting tubulin polymerization.

Materials & Methods: Study images were acquired using LC–OCT devices (DAMAE Medical, Paris), which enable painless and non-invasive imaging. These devices generate vertically oriented (histology-like) and horizontally oriented (similar to Reflectance Confocal Microscopy, RCM) sectional images, as well as full 3D volume reconstructions. LC–OCT technology operates through a two-beam interference microscope equipped with a supercontinuum laser (class 1 light source, central wavelength of 800 nm) and a line-scan camera as the detector. It measures both the time of flight and the amplitude of light backscattered from tissue microstructures illuminated by a focused line of light. This innovative technique integrates the interferometric principles of Optical Coherence Tomography (OCT) with the spatial filtering capabilities of RCM. Once the images were acquired, they were processed using an artificial intelligence algorithm to obtain data on keratinocyte atypia.

Results: Tirbanibulin has been found to be effective in the treatment of AK. Additionally, the implementation of AI-based algorithms for keratinocyte segmentation offers a cutting-edge method for detecting and quantifying keratinocyte atypia before and after treatment. These systems employ user-friendly colorimetric scales to enhance interpretability

Conclusion: The integration of advanced imaging techniques with targeted topical therapies marks a significant step forward in the personalized management of actinic keratosis, improving precision in diagnosis, treatment planning, and non-invasive follow-up care.