DEVELOPMENT OF BIOPHOTONIC DEVICE BASED ON FLEXIBLE LIGHT EMITTING TEXTILE DEDICATED TO THE MONITORING AND TREATMENT FOR DERMATOLOGIC DISEASES AND CARCINOMA

PHOS-ISTOS

WORKPACKAGE: 7

Validation, scale-up of technical textile

DELIVERABLE: 1

Project factsheet and public presentation slides

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1- Context

Actinic Keratoses (AK), also known as solar keratoses, are scaly or crusty growths (lesions) caused by damage from the sun's ultraviolet rays (UVR).

Actinic keratoses most often appear on the bald scalp, face, ears, lips, backs of the hands and forearms, shoulders, neck or any other areas of the body frequently **exposed to the sun**.



Actinic keratoses are frequently so small that they are recognized by touch rather than sight. It feels as if you were running a finger over sandpaper. There are many times the number of invisible (***subclinical***) lesions as many as visible ones on the skin surface.

Chronic sun exposure is the cause of almost all actinic keratoses. Sun damage to the skin is cumulative, so even a brief period in the sun adds to the lifetime total. Cloudy days aren't safe either, because 70-80 % of solar ultraviolet (UV) rays can pass through clouds. These harmful rays can also bounce off sand, snow and other reflective surfaces, giving you extra exposure. The ultraviolet radiation given off by the lamps in a tanning salon can be even more dangerous than the sun, thus dermatologists warn against indoor tanning.

While actinic keratosis is the most common pre-cancer, not all keratoses turn into cancers. Unfortunately, **there is no way to know ahead of time which actinic keratoses are precursors of squamous cell carcinoma**, the second most common form of skin cancer. Some experts believe that the actinic keratoses are actually the earliest stage of **squamous cell carcinoma**. That is why it is opportune to provide effective treatments for eliminating actinic keratoses in their early stage.

Up to 58 million of US citizens have actinic keratosis. Treatment options include ablative (destructive) therapies such as cryosurgery, curettage with electro surgery, and photodynamic therapy. **Photodynamic therapy (PDT) is well tolerated, has excellent cosmetic results, and has reported cure rates between 69 and 93 %, with fewer side effects compared to the other treatment options.**

2- Photodynamic therapy for the treatment of actinic keratoses

The therapeutic effect of the photodynamic therapy depends on a combination of parameters that include drug dose, drug-light interval, oxygen in cells and light irradiance rate. It also varies according to the wavelength distribution of the light source.

Finally, a **homogeneous and reproducible illumination during the clinical PDT is determinant in preventing under- or overtreatment**.

So, the aim of PHOS-ISTOS project is to develop light emitting flexible structures for the photodynamic therapy coupled with diode laser for an ambulatory biophotonic medical system. The main challenge in order to ensure the development of such treatment is to **guarantee a uniform light illumination** of the skin due to the complexity of the human anatomy.

The medical kit developed has a double function:

- **Provide homogeneous light** emitting source adapted to the human morphology of area to be treated.
- **Monitor the kinetic reaction of photosensitizer** and adapt the irradiance according to the patient's response.

The treatment against actinic keratosis precancerous cells and skin diseases with PHOS-ISTOS becomes:

- More successful,
- **Less painful** and provide more comfort,
- More sensitive due to the monitoring of photosensitizer reaction during the treatment,
- Avoid recurrence and offer a definitive treatment,

The pilot trials that will be processed in PHOS-ISTOS project will be made by professionals and will demonstrate the advantages.

These trials will also enable 1) **to optimize the product** that will be sold at the end of a comparative study with other existing devices and 2) to d**evelop similar solutions for other treatments** like psoriasis, basal cell carcinoma and acne.

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