

The Photodynamic Angle on Anti-Aging

The Medicine of Light Photoimmune Discoveries eBook Series.

Photodynamic therapy (PDT) is a light-based technique that has been used in the treatment of a wide range of health problems. In the standard treatment for photoaging and related skin problems, a photosensitizer or light-sensitizing cream is applied to the skin. A standard component of this cream is 5-aminolevulinic acid (ALA), which promotes the production of a natural photosensitizer that becomes concentrate in diseased, damaged or abnormal cells. Upon exposure to light, those same cells tend to die off more rapidly.

Over the past decade, a small handful of clinical studies have explored PDT's potential role in the rejuvenation of aged skin. In a recent study of 14 adults with photoaged skin, researchers at the Shanghai Skin Diseases Hospital in Shanghai (China) applied either ALA-PDT or red light alone to the forearm. Before and after treatment, the treated sites were carefully examined and measured for hydration, elasticity, and other specific changes in the skin. In addition, the investigators performed a microscopic analysis of key proteins, including various collagens and elastins that bear an integral relationship to skin health.

Both treatments were able to improve the skin's overall appearance and reduce photoaging lesions. Nevertheless, these changes were more pronounced in the ALA-PDT group compared to the red light group. The Shanghai authors concluded that ALA-PDT resulted in significantly better photorejuvenation when compared to red light alone.

Similarly, a recent Korean study showed that PDT helped clear the reddish patches on the skin known as actinic keratosis. The average remission rate after three PDT sessions was 86%. The same study found that PDT had rejuvenating effects on the skin, including significant improvements in various signs of photoaging such as coarse wrinkles, skin roughness, and erythema (redness of the skin). These findings were reported online ahead-of-print in the 16 September 2014 issue of *Photodermatology, Photoimmunology and Photomedicine*.

How Light Heals

PDT remains controversial for the treatment of aging skin aging in part because scientists don't yet fully understand how it works. They would like to identify the fundamental cellular and molecular mechanisms that underlie the photorejuvenation effects of this light-based therapy.

In the typical treatment situation, as mentioned above, a topical cream containing ALA is applied before the light treatment. This agent indirectly sensitizes abnormal cells to light, and the subsequent photodynamic reaction results in the generation of highly reactive

oxygen molecules (dubbed *reactive oxygen species* or ROS). These ROS are thought to aid in the destruction of damaged or abnormal cells.

Researchers at Ajou University School of Medicine, in Suwon, Korea, recently showed that the ROS generated during these treatments promotes the activation of a specific enzyme called *extracellular signal-regulated kinase*, or ERK. This enzyme, in turn, triggers the proliferation of fibroblasts, cells intimately involved in both wound healing and photorejuvenation. By activating ERK, photodynamic treatments seem to help skin regenerate or rejuvenate faster, as reported in a recent issue of the *Journal of Investigative Dermatology*.

In previously published research, the same group of Korean scientists had shown that ALA-PDT helped increase the amount of collagen in photoaged skin and had favorable effects on the shape of fibroblasts—all of which may help explain the treatment's capacity for enhancing the photorejuvenation process.

Other studies have shown that PDT may be combined with pulsed light and various skin rejuvenation agents in order to further boost the degree of photorejuvenation. It seems highly ironic that, while sunlight is thought to accelerate the aging of the skin (a process known as photoaging), light can also be used to reverse this process when combined with a photosensitizer in the proper way. The use of PDT as a way a vehicle for *photorejuvenation* will no doubt continue to be a major focus of intensive research in the years ahead.

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Sources

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