MODERN PICOSECOND LASERS FOR PIGMENTATION TREATMENT

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Abstract
At the heart of the development of dermatoses accompanied by a violation of pigmentation is undoubtedly the process of melanogenesis, which is a very complex multistage and difficult-to-
regulate. From a molecular genetic point of view, about 280 genes of various proteins, factors of cellular and intercellular interaction, regulating melanogenesis, have been found. Nevertheless, the scientific research of many scientists in recent years has made it possible to deeply advance in understanding the mechanisms of regulation of this process. In particular, the role of medium-wave ultraviolet radiation, predominantly spectrum B (UVB), on human skin, and the mechanisms of its biophotonics have been established. Ultraviolet B triggers cascades of reactions not only in melanocytes, but also in keratinocytes, which are predominantly more abundant in the epidermis and fibroblasts, which form the basis of dermal structures. Thus, these three groups of cells under the influence of excess UV radiation begin to stimulate the production and transport of melanin in the melanosomes into the keratinocyte cells in order to prevent damage to nuclear DNA. Melanin absorbs UV radiation very well and is a chromophore, thus protecting the skin from damage.

**Keywords:** laser, melasma, chloasma, hyperpigmentation, picosecond laser (PSL), PicoWay, Zoom, Resolve.

**Introduction**

Currently, one of the urgent problems of dermatocosmetology is skin diseases, accompanied by a violation of pigmentation and skin color, resulting from dysfunction of melanin formation. Melasma and chloasma in particular are one of the most common diseases among all patients with skin dyschromias up to 41% according to foreign literature. Moreover, women of reproductive age are most susceptible to this disease, as well as pregnant women, mainly in the 3rd trimester. Also, foreign authors point to the dependence of skin type in the development of melasma, mainly types III-V according to Fitzpatrick [1, 2, 3, 4]. Since the most significant provoking factor is ultraviolet radiation, in the world literature, the most susceptible population groups are noted, such as: East Asian, Central Asian, Latin American and Spanish, as well as Mediterranean African
groups. These data also indicate the territorial prevalence of melasma. Due to the fact that the population of Uzbekistan lives in conditions of increased insolation and exposure to ultraviolet radiation, and the development of this disease affects the quality of life of patients and is accompanied by psychological experiences, which makes this problem the most urgent and its solution, due to its low level of knowledge, is of great scientific and practical interest [5, 6].

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A promising direction of modern dermatocosmetology is the development of new technologies aimed at eliminating skin defects in dermatoses accompanied by a violation of melanogenesis, in particular hyperchromia. These diseases include: Melasma, chloasma, post-inflammatory hyperpigmentation [10]. Each of these diseases is manifested by hyperpigmentation, telangiectasias in visible areas of the skin. Such a clinical picture of the disease, mainly affecting the person, brings patients not only suffering, but also reduces the quality of life. The therapy currently used for hyperchromic dermatoses does not always satisfy both patients and dermatologists. The pathological process often recurs [11, 12, 13].

Based on the above, the development of a new method of etiopathogenetic therapy in patients with melasma / chloasma, post-inflammatory hyperpigmentation is very important.

**Materials And Methods**

We carried out therapy in 51 patients with pathologies such as melasma, chloasma and post-inflammatory hyperpigmentation.

The therapy was carried out once every three weeks for 6-7 months.

The majority of patients -46 (90%) received therapy without side effects. Some patients -5 (10%) felt light-headedness and headaches after the procedure. But all side effects were stopped within 5-10 minutes, without drugs.

Improvement of the process, lightening of hyperpigmented spots and improvement of the quality of the skin took place in 3-4 procedures.
Results And Discussion
Several treatments are available, from topical therapies to chemical peels and lasers. The advent of ultrashort pulsed picosecond lasers (PSL) has transformed the treatment of tattoos and benign pigmented lesions. The PicoWay laser from Candela is a 3-wavelength picosecond laser with high peak power. Picosecond lasers have been around for less than 10 years and are characterized by the ability to generate extremely short pulses in the picosecond range. This means that the light exiting a laser, once pulsed, will travel at a speed of nearly 1 trillionth of a second. This speed will cause some "shock waves" in the target tissue, which will result in mechanical destruction of the target without the need to generate large amounts of heat. The targets are ink particles in the tattoo and small melanosomes that contain the pigment melanin. Thus, the PicoWay laser is the best choice for the treatment of tattoos (both amateur and professional) and all pigmentation problems, including melasma, hyperpigmentation, post-inflammatory hyperpigmentation, Ota nevus and many other conditions. The three wavelengths include 532 nm, which are used for red, orange and purple tattoos, as well as superficial pigmentation called "epidermal". The 785 nm wavelength in the PicoWay laser is used for green and blue tattoos, while the 1064 nm wavelength is used for black tattoos or deeper pigmentation, often referred to as "dermal" [14, 15, 16].

The PicoWay laser also has a special fractional tip called the Resolve tip. It is a unique fractional handpiece with two wavelengths: 532 and 1064 nm. It creates a very complex microscopic injury in the skin called "light-induced optical breakdown" that triggers a cascade of wound healing pathways that ultimately leads to smoother skin, even tone and better collagen [17, 18]. Therefore, Resolve PicoWay laser tips are used in the treatment of acne scars, enlarged pores, uneven tone and pigmentation, stretch marks, dull skin and general facial rejuvenation. PicoWay laser treatments are painless and fast given the ability to use speeds of up to 10 Hz per second, which means any treatment will take anywhere from 5 minutes to half an hour at most, depending on the condition.

Unlike long-pulse lasers (millisecond and microsecond) and Q-switch lasers (nanosecond lasers), PSL delivers very short pulses of one trillionth of a second (range), which is predominantly photomechanical rather than photothermal. This, in turn, improved tissue safety with fewer complications, especially for higher Fitzpatrick skin types. There are several PSLs with different pulse widths and wavelengths. We used two new Candela PSL tips called Picoway. The Picoway system is a PSL with six handpieces covering four wavelengths (532, 730, 785 and 1064 nm). Non-fractional tips are called Zoom (532 and 1064 nm) or Full Beam (730 and 785 nm), fractional tips are called Resolve (532 and 1064 nm).

In 35 (68%) patients, dermatoscopic examination revealed an improvement in the quality of the skin, a decrease in mimic wrinkles for 2-3 treatment procedures. Reduction of hyperpigmented spots by 2-3 procedures.

In 47 (92%) patients, complete recovery occurred at 6-7 months.

Figure 1. Results before and after the picowave treatment
Conclusion

Laser treatment of benign pigmented lesions requires the selection of the correct wavelength and parameters to provide high clinical clearance with low complication rates, especially for higher skin types. This wavelength (1064 nm) is unique in that it is highly absorbed by melanin with very low hemoglobin uptake. It also has the shortest pulse width of any PSL wavelength. This is important because it is shorter than the stress relaxation time of the melanosomes, resulting in a predominantly photomechanical method of pigment removal with little collateral damage. Resolve Fusion 532nm provides a set of microbeams that combine a high energy density center beam and a low energy density peripheral rim to provide more coverage in a single pass with less exposure to the center beam, resulting in fewer side effects such as petechiae on more high skin types. This fractionated beam produces a distinct microscopic damage called light-induced optical degradation, signaling the cells to rejuvenate and mechanically disrupting melanosomes, resulting in improved clearance of diffuse pigmentation with minimal healing time.

References


