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THE INFLUENCE OF UV LAMPS ON THE CONDITION OF NAILS AND HAND SKIN: DERMATOLOGICAL ASPECTS

Summary. *The manicure procedure with gel polish coating of the nail plate is one of the most popular and profitable among salon and office procedures in the nail beauty business. Despite its aesthetic importance for the client, it can sometimes be a procedure for rehabilitation correction of nails in certain diseases or after injuries. Its relative safety has been proven even when using ultraviolet lamps (UV lamps) to accelerate the polymerization of the gel. In order to avoid possible medical risks and increase the effectiveness of the procedure, it is recommended to use a new generation lamp (LED) with higher intensity, narrower radiation spectrum (365 nm - 405 nm) and shorter exposure (10-60 seconds). An important point of protection that should not be neglected is use of protective creams according to the intensity of radiation, protective gloves, glasses. Of course, it is mandatory to comply with the protocol of their use and the regimen (no more than once every 3 weeks) when using equipment such as UV lamps to prevent possible medical complications. Dermatology specialists are mostly inclined to believe that the risk of complications from using UV lamps for manicures with gel polishes, such as skin and nail cancer, melanoma, etc., is low, but it does exist. Therefore, further observation with subsequent study of*

statistical data of clinical cases in periods after 20-30 years of constant use of UV lamps in the manicure industry is relevant.

Key words: *gel manicure; melanoma; nails; skin cancer; ultraviolet nail lamps.*

Introduction. The popularity of the manicure procedure using various coatings in the form of varnishes, gels, acrylics is due to the trends of the fashion industry, the development of the nail business industry, medical indications for the use of coating materials in the correction of nail plates changed by illness or injury. It is difficult to imagine how many factors must be taken into account so that the manicure with a coating meets the requirements of the master, the client, is affordable, meets hygiene requirements and safety. The manicure with a coating procedure is not new and has a rich history of introducing new methods and tools into the practice of the nail business. Back in 1957, a dentist named Frederick Slack proposed using dental acrylic for nail plate extension [5]. The proposal captivated specialists and those wishing to try acrylic correction and grew into a large business direction with its ramifications for the need for additional reagents and tools necessary for working with acrylic. Over time, the gel correction method joined the acrylic nail correction method as an alternative option, which has now displaced its predecessor from the nail business, as it turned out to be simpler, cheaper, faster, safer and more promising in terms of further profitable growth. Nowadays, the use of gel polishes in the nail beauty industry is a mandatory item on the ironing list of beauty salons and manicure offices. The procedure for nail correction using gel polishes is profitable, in demand, but also expensive, especially in terms of the initial purchase of hardware, the gels themselves and additional materials. Despite the aesthetic and economic advantages of the method, the use of UV lamps for gel polymerization is of concern in terms of the impact of ultraviolet radiation on the skin and nail plate with a possible carcinogenic effect. [11]. Therefore, studying the potential

risks to the client's health from the use of UV lamps during the gel polish manicure procedure is an extremely relevant topic.

Novelty. The novelty of our review is represented by the analysis of modern types of lamps (UV vs. LED) in the context of cumulative radiation dose and assessment of the effectiveness of protective equipment (SPF creams, gloves) under real conditions of salon and office procedures.

Research objective. The aim of the study was to assess the characteristics and nature of the impact of UV lamps on the morphological condition of the nail plate and skin of the hands, as well as to determine the degree of dermatological risks.

Tasks:

- Analyze spectral characteristics of modern manicure lamps.
- Learn clinical manifestations of photoaging and dehydration skin after regular procedures.
- Experience impact on the structure of the nail apparatus (onycholysis, brittleness).
- Form recommendations of minimizing negative impact.

Radiation characteristics manicure lamps

Ultraviolet waves have long been used in various devices from manicure lamps to therapeutic panels. According to their wavelength and effect, they are divided into 2 main types: UVA and UVB. In comparative terms, UVA (315–400 nm) has the longest wavelength in the UV spectrum and the lowest energy, which gives grounds for its use in manicure lamps for polymerization of gel polish components and in solariums. It is important that UVA (315–400 nm) – waves due to their length have the ability to reach the deep layers of the epidermis of the skin, affecting the basal layer. UVB (280–315 nm) on the other hand have a shorter wavelength and higher energy of impact, therefore they are used mainly in medicine for the treatment of certain skin diseases (psoriasis, atopic dermatitis [10], vitamin D synthesis and other effects of phototherapy [13]. With a short

wavelength, these high-energy waves with low permeability have a high ability to stimulate biological processes [7].

Wavelength range required for gel polish polymerization (315–400 nm) provide LED and UV lamps. UV lamps, according to their technical characteristics, operate on the principle of gas discharge (mercury), require a longer warm-up time and a longer exposure time (2-3 minutes for gel polish polymerization). A disadvantage that can cause some discomfort to the client may be low energy efficiency, since 80-90% of the energy when using these traditional lamps is converted into heat. Modern LED panels use semiconductor diodes to generate waves, which makes them more energy-efficient and safer for the eyes and skin by reducing the exposure time. The work of LED panels focuses on generating a fairly narrow spectrum of waves of 365 nm and 405 nm, sufficient for gel polymerization. Having a higher intensity, compared to UV lamps, LED panels allow you to save energy, due to a shorter exposure time (10-60 seconds) which reduces the harmful effects on the body. In addition, higher energy efficiency has been proven LED panels, which prevent the heating of tissues in the radiation zone [14].

Photoaging and damage skin

In the flow UV radiation, as a key factor in photoaging of the skin, has been proven in a number of scientific studies. The action of natural UV waves is partially blocked by the Earth's ozone layer, and the relationship between skin cancer and the intensity of solar radiation, especially in places with a thin ozone layer, has been proven for a long time. The skin of the hands is mainly an area of the body that is subject to constant exposure to external traumatic factors. Morphologically, it is distinguished by thin hypodermal and dermal layers, which adds the risks of rapid photoaging to natural chronoaging [2]. Therefore, the additional negative impact of UV waves from manicure lamps during the procedure of coating nail plates with gel polish is of concern in terms of possible medical risks.

Among the common manifestations of skin damage by UV waves, the following are currently distinguished: solar lentigo, skin atrophy caused by pathological changes in collagen and elastic fibers in its composition, and impaired trophism and regeneration. Let us briefly consider the mechanisms of each change. Solar lentigo is not an isolated process of the appearance of pigment spots on the skin under the influence of UV rays. As a rule, it is accompanied by degenerative changes in the skin layers, which exacerbates the problem, the manifestation of which is exhausted thin, wrinkled skin with dark spots of uneven contour and varying degrees of color saturation. The cause of the spots is the activation of melanocytes, which are located mainly in the deep layers of the epidermis (basal and spinous) and are sensitive to the effects of UV rays. Remembering that UVA waves have a long length (315–400 nm) and are able to reach the deep layers of the epidermis and even the dermis, the process of activating melanocytes as producers of the melanin pigment is logical and understandable [15]. In addition to melanocytes, young, poorly differentiated cells are found in the basal and spinous layers of the epidermis. keratinocytes, which are also hypersensitive to the action of UV waves, under the stimulating action of which they are activated in their division and phagocytic abilities (usually they are called melanophages, absorb melanosomes and provide skin color) [8]. Keratinocytes, which begin to actively divide at this moment, without having time to fully mature, generate new populations of young cells, the accumulations of which turn into skin tumors (benign or cancer). Keratinocytes, activated as phagocytes, are concentrated locally in excessive quantities, accumulating melanin in the cytoplasm, contributing to the appearance of spots. Under the influence of UV radiation, stimulated melanocytes of the epidermis can also begin active division without fully maturing, accumulating in one place and generating tumors - melanomas [9]. Such generative and regenerative failure in epidermal cells is also a direct consequence of the negative effect of reactive oxygen species (ROS) on the DNA structure. This becomes the starting point for

changes in the chain of adjustment of post-embryonic induction of processes in cells, including the stages of the cell cycle.

Regarding degenerative changes in collagen and elastic fibers that make up the dermis and hypodermis of the skin, according to scientists, the main factor in the mechanism of this process is the generation reactive oxygen species (ROS) under under the influence of UVA and UVB rays. It has been scientifically proven that under the influence of ROS generated in the skin under the direct action of UV waves, enzymes matrix metalloproteinases (MMPs) break down collagen fibers. Another factor that contributes to the reduction in the amount of collagen and elastin is the blocking of the function of fibroblasts themselves. Atrophic changes in the dermis due to a decrease in the synthetic activity of fibroblasts, which are the main producers of connective tissue matrix proteins, are complemented by a decrease in the phagocytic activity of macrophages, which usually utilize abnormal components, freeing up space for new synthesis. The accumulation of modified biocomponents in the skin increases the state of oxidative stress and the level of ROS, closing the circle of pathogenesis.

It is known that UV rays destroy the water-lipid mantle of the skin and glycosaminoglycans, the most important of which is hyaluronic acid. Since the state and amount of hyaluronic acid in the skin determines its trophic and hydration, and elasticity and healthy appearance depend on these two categories, the logical consequence of UV irradiation of the skin is dryness, hypotrophy, hypotension, increased traumatism, and reduced regenerative capacity [4].

Impact on the nail apparatus

Since we are directly talking about the effect of UV radiation during the gel polish manicure procedure, it is time to highlight the possible risks for nails and adjacent structures. Since the nail is a derivative of the skin, due to the common source of their embryonic development, it is expected that the nail structure will contain the same cells that suffer from the action of UV waves, being part of the skin. The nail consists of a nail plate and a nail bed. The proximal

edge of the plate is called the root and is immersed under the eponychium, protecting the matrix. The nail bed is represented by the upper layer of the dermis (papillary), lined with poorly differentiated keratinocytes, concentrated in the form of a matrix, which are similar in structure to the basal and spinous layers of the epidermis. As in the epidermis, they are responsible for the growth and regeneration of the nail plate and are sensitive to mechanical, temperature and UV exposure. With a negative strong and prolonged effect, a violation of the DNA level of the nuclei of keratinocytes and melanocytes of the nail is possible, followed by the formation of epidermal tumors and melanomas. Prolonged exposure to UV waves, especially when using UV lamps, which have a thermal effect, can result in a thermal burn of the nail bed with damage to the capillary network and impaired blood supply to the germinal sources of regeneration and growth of the nail. This can cause onycholysis, and in the presence of a closed space under the nail plate, there is a risk of bacterial flora joining.

Oncological vigilance in dermatology

Despite medical caution regarding the possible carcinogenic effects of UV radiation on the skin and nails, regardless of the morphological grounds and the corresponding technical characteristics of the properties of UV waves, there are currently no experimental and reliable statistical data from a series of clinical cases that would prove a direct link between the use of UV lamps and skin and nail cancer [8]. Researchers believe that the risk is certainly there, but the protective effect of the stratum corneum of the epidermis and the water-lipid mantle of the skin should be taken into account. Cases of squamous cell carcinoma of the skin of the back of the hands have been recorded in women who used gel polish manicure services, during which UV lamps were regularly used, but it has not been proven that UV lamps cause more harm to the skin of the hands than natural intense sunlight [16].

Methods of dermatological protection

To avoid the harmful effects of UV waves, it is recommended to use protective creams with an SPF level according to the intensity of solar or artificial UV radiation (SPF 15 + -100 +), protective gloves, antioxidant therapy, both local (biorevitalization with polynucleotide preparations) and comprehensive, as a direct connection between amino acid metabolism and the state of epidermal protection has been proven [6]. Regarding the technical part of solving the protection problem, it is recommended to use LED panels, which have high energy efficiency with a significantly shorter exposure time compared to UV lamps and whose advantages have been proven.

Conclusions. The scientific literature contains quite contradictory data on whether ultraviolet radiation from the constant use of UV lamps for manicure procedures with gel polish coating increases the risk of skin cancer of the hands and nails, melanoma and other skin and nail diseases. It has been established that frequent use (more often than once every 3 weeks) of UV lamps causes destructive changes in the skin of the hands and nails, associated primarily with moisture loss, impaired blood supply and destructive changes in the main components (collagen and elastic fibers, fibroblasts), which makes physiological regeneration impossible and leads to hypotrophy, dermatological diseases. A review of literature of various directions, from special morphological to technical, regarding the physical capabilities of UV waves and the operation of lamps of various types, showed the possibility of a negative effect of UV radiation on the skin of the hands and nails, which can be avoided by using preventive measures and adhering to the regimen and protocol for using UV lamps. Despite the low risk of carcinogenesis in principle, one should not forget about the possibility of cumulative effects. Therefore, further studies of the impact of regular use of UV lamps in the work of a manicurist in terms of identifying long-term consequences (after 20-30 years of regular use) remain relevant and necessary. An important point is the development of safety standards and protocols for procedures in the

nail industry that use UV lamps to protect the health and rights of consumers and manicurists.

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