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GENERAL PUBLIC AND WORKERS PROTECTION ON USING OPTICAL RADIATION SOURCES FOR COSMETIC PURPOSES

M. Ivanova[1*], M. Israel[1,2], Ts. Shalamanova[1], Hr. Petkova[1], V. Zaryabova[1], M. Stoynovska[2]

[1]National Centre of Public Health and Analyses, Sofia, Bulgaria
[2]Medical University - Pleven, Bulgaria

Abstract. *Numerous sources emitting high levels of optical radiation are used for cosmetic purposes, but data available on human health protection differ significantly amongst different countries. The great variety of cosmetics' sources and their application by different population groups are the causes that make this problem an important public health and social issue. The literature review performed by the International Commission on Non-Ionising Radiation Protection (ICNIRP) shows that legislation of different countries and organizations covers devices considered as medical. There is no such legislation for most of the cosmetic devices. For many optical sources, only technological standards exist that regulate the product's performance. For others, the requirements are set in nonmandatory standards. A serious problem with the human health protection on use of such devices is that their application is a personal choice of the user - the exposure is voluntary. Our country has no policy for this type of optical radiation application except for the workers. A Directive for the protection of workers with similar sources is implemented in EU countries and transposed in Bulgaria, but its application is limited for use in cosmetics. Generally, the legislation covers applications of optical radiation defined as medical treatment only. There are no data on the number and qualifications of staff providing treatment in cosmetics. A policy for safety and health protection in this field is commonly missing for general public protection. Here, in this paper, the problem is addressed to the common sources used for cosmetics purposes (solaria, IPL systems). This article focuses on the common sources used for cosmetic purposes (tanning beds, IPL systems). The specific risks associated with the application of the sources are discussed. Based on the analysis of the problem, a development of specific legislation, corresponding to the specific health risks is proposed. The single data we have from measurements performed in cosmetic studios with sunbeds-show increased risk for the personnel and users as well. The aim of the study is to propose development of a policy for health protection on using optical radiation sources for therapeutic and cosmetic applications on the basis of scientific literature and on our own experience.*

Keywords: *Cosmetics, optical radiation, beneficial effects, risks, policy, protection, qualification*

1. INTRODUCTION

Numerous sources emitting high levels of optical radiation are used for cosmetic purposes, but data for human health protection during the procedures differ significantly amongst the countries. The literature review performed by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) shows that regulations refer to devices that are considered analogous to medical [1] and do not cover most of the cosmetic applications.

Cosmetic applications of optical radiation utilize some of its biological effects on treated individuals who wish to alter their appearance for aesthetic reasons. The advantage of these applications is that they avoid invasive procedures such as plastic surgery and injections. Due to the biological effect to be achieved, more often they are considered on the border of therapeutic applications, with some of the sources being considered as medical equipment.

For many optical sources, only technological standards exist that regulate the product's performance. For others, the requirements are set in voluntary standards [2–6]. A serious problem with the sources in cosmetics is that their application is a personal choice of the user - the exposure is voluntary often without consultation with a physician and the choice of procedure provider depends on the user's preference.

Generally, the legislation does not cover applications of optical radiation not defined as medical treatment for the persons receiving treatment (general public) for cosmetic purposes. There are no data on the number and qualifications of staff providing treatment, as well. A policy for safety and health protection for the general public is commonly missing.

Bulgaria has a policy for health and safety regarding the exposure to optical radiation only for workers. The legislation is based on the transposed in Bulgaria Directive 2006/25/EC for protection of workers with similar sources [7, 8], but its application is limited. There are no available data from measurement and exposure assessment in the field of cosmetics.

In this situation, the protection of the population undergoing cosmetic procedures with optical radiation and the staff in cosmetic studios and medical centers cannot be guaranteed.

2. AIM

The aim of the study is to investigate the application of optical devices in cosmetic practice and to propose

* mihaela_1970@abv.bg

development of policy and safety measures for the health protection of workers and the general public.

3. Materials and methods

For the aim of the study two Internet researches were conducted.

The first one was directed to the applications using optical radiation in cosmetic studios and medical centers. The used keywords were: cosmetic studio, beauty center, aesthetic center, cosmetic center/beauty salon, SPA center, laser center. We have taken the data for the first appeared studios and medical centers in the Google search for which there is needed information. The main categories of sources/applications found in reviewed centers and studios are presented in Table 1.

The second search was connected to solaria studios with different types of artificial tanning devices.

Here, the used keywords for the search were: solaria, solar studio, tanning studios. We consider the data of the first appeared solar studios or tanning facilities with available information.

3.1. Cosmetic studios and medical centers

The sources of optical radiation used in cosmetic studios and medical centers are of similar types and in most cases are applied for the same purpose. That is the reason for the results of the Internet research to be presented in one table. However, there is a big difference to be considered: medical center vs cosmetic studio. The procedures using such high optical energies have to be performed only by a medical doctor trained in safe application of the sources.

As a result of the study, we have found the following applications of sources emitting optical radiation (OR) in 52 studios and 5 medical centers. Data for the cosmetic studios are listed in Table 1 with Arabic numbers and for the medical centres with roman ones.

The main categories of sources/applications listed in the table are used to achieve the following effects:

Laser therapy – includes different types of lasers: diode (810 nm), CO_2 (10.6 μm), Yb:YAG (1030 nm), Nd:YAG (1064 nm), Alexandrite (755 nm) used for skin rejuvenation; liposuction, lifting, removing of wrinkles, scars, tattoos, pigmentation, capillaries, treatment of skin conditions as acne, rosacea; SHR /IPL treatment, laser peeling;

Laser epilation/hair removal – one of the most popular laser applications in cosmetics in the last years;

LED phototherapy/photodynamic therapy – primarily for skin rejuvenation;

IPL (Intense pulsed light) devices (λ = 570 nm – 950 nm) or laser/IPL device, skin rejuvenation, removing of capillaries, epilation/hair removal;

IR (infrared) devices for skin tightening and wrinkles treatment;

Despite optical radiation, there are devices that emit in other parts of the NIR spectrum (mainly RF) sources and/or ultrasound as well.

There are devices that combine several types of emissions. The most common combinations are RF currents and IPL/laser (and/or IR source) (Figure 1). That is the reason to be included in Table 1.

Table 1. The main categories of sources/applications found in studied centers and studios

Studio	LED therapy	Laser-therapy	IR therapy	IPL	Laser hair removal	Ultrasound	D' Arsonval	RF therapy
1					☑			☑
2						☑	☑	
3					☑	☑		
4	☑				☑	☑	☑	☑
5	☑	☑				☑	☑	
6		☑			☑	☑		☑
7						☑	☑	☑
8		☑				☑	☑	☑
9		☑	☑			☑		☑
10	☑					☑		☑
11						☑		
12						☑		
13					☑	☑		☑
14								☑
15						☑		☑
16	☑				☑	☑	☑	
17								☑
18				☑		☑		☑
19						☑		
20					☑	☑		☑
21						☑	☑	☑
22	☑							
23						☑	☑	
24					☑		☑	
25						☑	☑	☑
26		☑			☑			☑
27					☑	☑	☑	☑
28		☑			☑			☑
29							☑	
30					☑	☑		☑
31						☑	☑	☑
32					☑			☑
33								
34				☑	☑			
35								
36		☑	☑		☑			☑
37				☑	☑			☑
38	☑	☑			☑			
39	☑							
40		☑			☑			
41					☑			
42		☑			☑	☑	☑	☑
43		☑		☑	☑			☑
44		☑	☑		☑			☑
45			☑		☑	☑		☑
46						☑		
47					☑	☑		☑
48					☑			
49		☑	☑		☑			
50	☑	☑		☑	☑	☑		☑
51		☑		☑		☑		☑
52					☑	☑		☑
I.		☑			☑			☑
II.	☑	☑			☑	☑		☑
III.		☑		☑	☑			
IV.		☑			☑			☑
V.		☑		☑	☑	☑		☑

Figure 1. IPL for hair removal (VIS + IR)

Regardless the achieved effects and the benefits of applying optical radiation cosmetic procedures, there are data about health risks for users and personnel performing cosmetic procedures in the scientific literature [9, 10]. A poll performed on behalf of the Federal Office for Radiation Protection in Germany (BfS) [10] has shown that about one-fifth of the treatments resulted in permanent side effects, such as scars. Another two-fifths had non-permanent side effects. The harmful effects connected with the use of optical sources in cosmetics in the scientific literature [1, 9, 10] are as follows: eye damage, pain, burns, pigmentation, scars, persistent erythema, and erythema, mainly reported in cases of improper use by unskilled operators; procedures performed by operators who are not aware of possible risks, improper selection of equipment or radiation regimen. Procedures performed near the eyes could also lead to eye injuries and vision problems.

Such results could be achieved because of lack of qualified personnel operating with the devices; when using low quality or not maintained devices; if safety measures are missing; when the time duration and the applied energy are not suitable for the individual characteristic of the consumer procedure or in enhanced photosensibility.

3.2 Solaria

The purpose of the solaria procedure is a tan to be achieved and good appearance. Many people consider intense sunbathing/artificial UV tanning to be normal and tan is seen as a symbol of good health, prosperity, and attractiveness. This is the reason that in recent years a new type of addiction namely tanning addiction (tanorexia) attracts the attention of the scientists [11]. Meanwhile many harmful effects as a result from using tanning devices on human health are proven [11]-[13]. Erythema, phototoxic and photoallergetic reactions as well as photokeratitis and photoconjunctivitis of the eye are acute effects amongst them.

In 2012, the International Agency for Research on Cancer (IARC) classified UVA, UVB and UVC radiation ranges of optical spectrum and the use of UV-emitting tanning devices as “carcinogenic to human” – Group 1. In previous IARC working group revision (1992) only solar radiation was incorporated in Group 1 of human carcinogens [13].

Earlier in its press release IARC concluded that there is no positive effect from the use of artificial UV radiation for tanning [15].

Photos presented in figures 1 and 2 illustrate examples of devices used in cosmetics.

Figure 2. Solar bed

4. Results and discussion

The available data of optical sources characteristics and single data of our measurements of optical radiation performed in cosmetic studios demonstrate an increased risk for the personnel/indoor UV exposure consultants and customers as well.

Our survey shows that in medical centers the procedures are performed by or under the supervision of a medical doctor (dermatologist). This is not the practice for beauty salons.

The advertisements in the cosmetic centers/beauty salons claim that the procedures are performed by qualified staff. However, our experience in the assessment of lasers in cosmetics shows that the staff is qualified in the procedures performed, mainly by devices provider, but very rarely has specific education regarding the safe use of optical radiation (laser and non-laser). This is the situation regardless–that a requirement for training on the safe use of lasers in particular was introduced in the national legislation since 1986 but, due to the lack of control it is not followed. Similar requirement for providing information and training of workers with optical sources is set in Directive and current national legislation as well [7, 8]. Performing procedures by untrained personnel could lead to serious consequences for safety and health not only for workers, but for general public as well.

In most of the studied solaria there is information only concerning the beneficial effects of using sunbeds: Vit D synthesis, stimulating collagen, synthesis as a means of avoiding seasonal affective disorder (SAD), preparing the skin for sun exposure, good appearance, and bactericidal effect.

In some of the tanning facilities, the harmful effects as carcinogenesis (including melanoma), skin burns, eye inflammation, accelerated skin ageing are categorically denied, as they are attributed only to solar radiation. There are also clear statements that they do not accept the categorization of the use of tanning beds for cosmetic purposes as a proven carcinogen (group I) by the International Agency on Research of Cancer [12]. There are also studios where the harmful effects of artificial tanning have been declared.

In several studios, there was a warning about the contraindications to the use of sunbeds, including groups of drugs that are photosensitizers, a recommendation not to be used by persons on age under 16/18 years, after laser hair removal, with tattoos, etc.

It is also recommended to know the skin type in advance. In some of the solar studios, the Fitzpatrick scale has been published with instructions on how to use it so that customers can determine their skin type themselves. In our opinion, this approach does not correspond to the proven risks associated with UV exposure.

In the survey, we did not find studios that provide consultation with a physician/dermatologist. Only one of the solar studios including several tanning facilities required the completion of a questionnaire similar to an informed consent form.

The current situation with the legislation for optical radiation in our country is the reason for lacking or insufficient protection of the workers/exposure consultants in cosmetic studios and tanning facilities. Improper use or insufficient training of staff in the safe use of optical radiation sources can also be a prerequisite for health risks for customers of cosmetic and solar studios.

Usually in Cosmetic practice sources that emit optical radiation with levels exceeding the exposure limits for the corresponding spectral range are used. A strict application of exposure limits is not possible, as this will exclude the expected effects of cosmetic applications.

Our survey of legislation for the safe use of solaria on an international level [15] has shown different approaches and different levels of protection amongst the considered countries. It varies from a complete ban of solaria, a ban only for minors, specific policy, or missing legislation. The last one matches is the situation in our country.

In general, the legislation does not cover specific applications of optical radiation that are not defined as therapeutic. In some countries in Europe and around the world, devices for tattoo removal, hair removal, fat reduction, and other interventions on the skin are considered medical treatment and as a result, covered by legislation and control. In order to reduce the harm associated with the use of cosmetic devices, ICNIRP considers it necessary to adopt normative documents covering all types and frequencies of cosmetic devices emitting non-ionizing radiation and to control their use [1].

Following the problem analysis, we consider that there is a need to propose the development of specific legislation for these sources corresponding to the proven health risks.

Development of workers/consumers protection legislation should be based on current knowledge concerning the biological effects and specifics of considered sources: technical characteristics, and manner of application. The main issues to be covered by the legislation should be the following:

- Requirements for devices – characteristics, emission performance (on the basis of available standards for products); it could be included in specific licensing scheme of devices;
- Measurement and evaluation of NIR as a part of licensing scheme;
- Requirements for the places for installation/use of the devices;
- Setting an age limit for use where appropriate (sunbed use for example);
- Qualification requirements for operators/beauticians;
- Introduction of requirements/rules for certification of beauticians/for safe use of NIR sources;
- Requirements for prior and periodic training of personnel;
- Forbidding unsupervised tanning services;
- Preventing sunbed use by individuals at high risk;
- Requirements for filling in an informed consent form for every procedure using optical radiation sources in cosmetics including tanning;
- Development and distribution of brochures and other informational materials as a part of communicating risks to the general public;
- Banning of sunbeds promotion (in several countries there is a ban on all sunbed services).

Introduction of a system for control including all requirements set in the legislation.

Proposed approach corresponds to the WHO requirements for adherence to the same principles/approaches for non-ionizing radiation protection as for ionizing radiation.

5. Conclusion

The main results of our survey are as follows:

- in cosmetic studios, beauty centers and tanning facilities customers are not protected against harmful effects of optical radiation;
- the personnel working in such facilities also is not protected;

- in general, the personnel in such facilities doesn't receive training on safe application of optical radiation sources;
- the legislation for workers health and safety on using optical radiation has very limited application.

These results and the numerous proven harmful effects from overexposure to optical radiation highlight the need to develop specific policies and regulations for human health protection in cosmetics and tanning facilities in Europe and specifically, in our country.

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