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FEATURES OF DIGITAL VISUALIZATION OF SCARRING TISSUE AND INDIVIDUAL-PERSONAL CHARACTERISTICS OF PATIENTS WITH HEAD AND NECK HYPERTROPHIC SCARS

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Summary: The paper presents the algorithm of comprehensive examination of 64 people with head and neck hypertrophic scars. Clinical examination of patients was supplemented with an assessment of their psycho-emotional state and digital visualization of the graphic image of the scar area. The authors prove convincingly that a RGB-visualization enables to differentiate the type of scar tissue. The detected psychoneurotic disorders arising against the background of existing cosmetic defect can act as an additional factor for complications of the disease. The results of the research extend the possibilities to design the pathogenetically justified treatment of patients with head and neck scars.

Key words: hypertrophic head and neck scars, RGB-visualization, evaluation of emotional status.

The relevance of the problem. In the modern surgical stomatology, the problem of improving the quality of diagnosis and treatment of patients with scars of the head and neck is actively developed. The need for in-depth study of these important issues is first of all due to the fact that even in developed countries, approximately 55% of cases of postoperative skin lesions healing resolve with rough scarring [1, p.32; 2, p.57]. It should be noted that of fundamental importance is not only the fact and the extent of a certain functional or aesthetic defect in scar tissue changes, but also the degree of their negative influence on the process of physical, psychological and social adaptation of the patient, which brings this problem closer to medical and social spheres [4, p. 320; 5, p.60].

The development of algorithms for treatment and rehabilitation of such patients is difficult due to the uncertainty of the criteria for differential diagnosis of various types of scarring. Despite significant pathogenetic and morphological differences in scarring, some of their variants often have clinically similar features, which leads to a significant number of diagnostic errors. In its turn, the treatment without taking into account the clinical and morphological structure of scarring leads, as a rule, to a lack of reliable therapeutic effect, relapses and increased growth of scar tissue [3, p. 319; 6, p. 31; 9, p.241]. Therefore, effective treatment of patients with scarring of the skin is possible only through the development is differentially-diagnostic criteria for determining their various types.

Currently, the scientific interest is drawn to the study of skin using non-invasive methods, such as RGB-visualization of digital images. Positive results of the use of this method for studying skin changes in some diseases offer a wide range of opportunities for their application and determining the morphological structure of scar tissue [7, p.71; 8, p.281].

It should be noted that the majority of works devoted to the diagnosis and treatment of scars pay attention to the direct impact on the area of the scar. At the same time, patient's general condition is insufficiently studied. Thus, the fact of formation of different morphological types of scar in one and the same place during operation in different periods of patient's life is known, which is caused, according to the researchers, by macrostate of the body [10, p.53; 11, p. 54, p. 12, p. 32]. In this regard, the issues of mental and emotional state which plays an important role in tissue regeneration processes during the reconstructive operations remain out of focus of the researchers' attention.

The aim of the research was to enhance the effectiveness of treatment of patients with hypertrophic scars of head and neck due to determining the features of the scar-modified tissues based upon RGB-system visualisation, as well as a detailed study of their individual and personality characteristics.

Materials and methods of the research. In this study, 64 patients with hypertrophic scars of the head and neck were examined, with the period of development of scar tissue from 3 to 12 months. Under our supervision, there were patients in whom the type of scar was previously confirmed not only clinically but also morphologically. The data was taken from the symmetrical intact area of the skin as a normal value.

Clinical examination of patients was complemented by visualization of digital images using the RGB system. It is known that with a large digital increase on the monitor screen, a grid is visualized that consists of three basic colors, which in the computer technique are measured by numbers in the range from zero to two hundred and fifty-five, where zero is the absence of this color, two hundred and fifty-five is maximum of its presence. Hence, the maximum clean red value is defined as R/255 – G/0 – B/0. By analogy, green and blue colors are determined. This is the simplest color rendering model, called the RGB system. An additional analysis of the structure of scar tissue was carried out by ultrasound using Nemio MX SSA 590A (Toshiba) device with a pulsed ultrasonic wave reference.

During the research, quantitative indicators were measured at the following points: T1 – the area of intact skin around the scar, T2 – the area of the medial edge of the scar, T3 – the area of the lateral edge of the scar, T4 – the middle area of the scar. Furthermore, the study of the ultrasound pattern was additionally carried out at the following points: L1 – the border between the epidermis and the scar tissue, L2 – the border between the scar tissue and the hypodermis, L3 – the border between the medial edge of the scar and intact derma, L4 – the border between the lateral edge of the scar and intact derma. In addition, for the purpose of objectification of the data we introduced 2 coefficients: L1/2 – the index showing the nature of the change in the echogenicity parameters in the central and peripheral tissues of the scar in its middle zone; L3/4 – the index showing the nature of echogenicity changes in the medial and distal edges of the scar.

Mental and emotional state assessment ("SMEL" questionnaire) was used for all patients with head and neck scars. This technique is used, in particular, to diagnose the general inconsistency in the personality system, accentuation, psychopathic features of the character, the level of neurotization, and the like. Standardized multifactorial method for studying personality (SMPT) contains 13 scales: 3 control (L – insincerity, F – reliability, K – correction) and 10 clinical, which give an opportunity to measure the degree of severity of neurotic overcontrol – 1 scale, pessimism – 2, emotional lability – 3, impulsivity – 4, masculinity-femininity – 5, rigidity – 6, anxiety – 7, individualism – 8, optimism and activity – 9, social introversion – 0. The degree of severity of each of these properties is evaluated according to the following principle: high values (above 70 T-points); increased scale (56-70 T-points); average values of the scale (45-55 T-points); decreased scale (44-30 T-points); low scale values (below 30 T-points).

Results and discussion. Today, computer digital image research is widely used in histological, cytological, pathologic and immunological studies, which led us to consider the use of digital analysis of images

as the initial stage of primary diagnosis in various types of postoperative scarred facial tissues.

Computer imaging is still the only source for obtaining visualized qualitative and quantitative information and preserving it in digital form. It is important that the camera matrix turns the shade of the image into a microscopic grid, each cell of which (pixel) is assigned digital data. When transferring information to a computer, the physician gets the opportunity to digitally increase the image by hundreds of times with minimal loss of quality and obtaining quantitative and qualitative characteristics of pixels with subsequent mathematical treatment.

Under ideal lighting conditions (IC), imaging was performed in macro mode at a distance of 40 cm, with the flash off and without optical magnification. Under satisfactory lighting conditions (SC), imaging took place at a distance of 80-90 cm, without flash, with minimal use of optical magnification. Under poor lighting conditions (PC), imaging was carried out at a distance of 110-120 cm, with the flash turned on and with the maximum possible optical magnification.

In optical analysis of the obtained photos on the computer monitor, it can be concluded that hypertrophic scars are well visualized and are different from intact skin. Analyzing the data, we have created a standardized table of numerical values for distribution of color components in the RGB system (Table).

Table

Distribution of intervals in digital values of colored components in the RGB system when visualizing scars and intact skin

Quality of lighting		T. 1	Hypertrophic scar		
			T. 2	T. 3	T. 4
IC	R	182±3	188±2	185±2	187±2
	G	128±2	140±3	130±3	132±3
	B	111±2	124±3	112±3	113±3
SC	R	179±4	184±2	180±2	181±2
	G	126±3	135±3	126±3	128±3
	B	108±6	116±5	111±5	112±5
PC	R	176±5	182 ±5	179 ±5	180 ±5
	G	124±4	130±5	125 ±5	126 ±5
	B	101±3	109±2	107±3	108±3

Note: IC – ideal lighting conditions;
SC – satisfactory lighting conditions;
PC – poor lighting conditions.

Analyzing the data from the table, one can conclude that the discrepancy between the values of different color spectra in the RGB system at T1 varies under different lighting conditions with the greatest spread of confidence intervals under satisfactory light conditions. All indicators of intensity in spectral radiation tend to decrease. Hence, the indicator of red color tends to decrease by an average of 4 units, just as in the indicator of the green spectrum.

The average values of the reduction in the intensity of the blue color equals to 10 units. Thus, the spectral color characteristic of intact skin depending on the conditions of illumination is influenced by the blue color spectrum.

At the stage of digital imaging of hypertrophic scar tissues, we found out that the intensity of the reduction parameter in the reliable intervals of digital values of the red component in the RGB system on average equals 6, which is reliably lower in the dynamics of changes in the green spectrum, which was on average 10 units, the largest differences T2 were observed in the blue spectrum, which was on average 15 units.

When studying the dynamics of changes in the components of T3, it should be noted that the digital values of red color intensity decreased by 6 units, green and blue – by 5 units. In T4, the following values were obtained: the reliability of reduction in the indicator of red color was 7, green – 6, and blue – 5 units.

Thus, the conducted quantitative digital color analysis proved that hypertrophic scars differ from intact skin in the digital components of the spectrum, and also differ in confidence intervals of the range and change in the digital color indices at different areas of the scar.

The study of their individual and personality characteristics shows that the patients with hypertrophic scars in the averaged profile the indicators by almost all scales were above the norm. High scores by the scale of neurotic over-control in these patients indicate that they are characterized by an excessive focus on their physical defects, they are skeptical of the treatment process, are characterized by demanding attitude to others. Most patients with pathological scars are characterized by hypochondriacal fixation and reduced adaptive capacity. The pessimism scale was leading in the profile of these patients. High levels on the anxiety scale confirm that such patients are characterized by obsessive anxiety, low displacement level, therefore even minor life problems cause tension and anxiety.

These patients try to avoid contact with the outside world, distance themselves from the social environment. Externally, they make the impression of socially isolated people, although in reality they have a need for communication, deep and long-term relationships with others. Depressive condition, on the one hand, can be considered as a result of a cosmetic defect presence, and on the other hand, it can be assumed that such experiences are the reflection of premorbid characterological status.

The average quantitative indicators of the emotional lability scale in patients with hypertrophic scars differed significantly from those of healthy patients. High data at this scale (on average 71.3±1.9 T-points) indicate that unfavorable somatic conditions are combined with the complexities of social adaptation. These patients are characterized by demonstrative behavior, the desire to be in the center of attention, to receive help from others. High indexes of the scale of emotional lability indicate an advanced ability to eliminate anxiety, but in these patients it is blocked by pronounced depressive symptoms.

53.13% of people with hypertrophic scars of the maxillofacial area were characterized by impulsivity. Thus, the mean values in these patients at the 4th scale were 78.3±2.5 T-points. High levels of anxiety (71.8% ±3.8 T-points) indicate that such patients experience an overwhelming anxiety. The fact of existence of a low level of displacement attracts attention, therefore even minor life problems become the cause of tension and anxiety. The presence of a facial defect causes the patient's isolation, anxiety about one's significance, becomes the basis for alienation from the society and affective reactions.

It should be noted that the combination of elevated indicators of scales 2, 4 and 7 points to such personality features of patients with hypertrophic scarring as impulsivity and instability of interests for the purposes of treatment, inability to make the necessary conclusions from the obtained experience, which causes the occurrence of internal conflicts, instability of interpersonal relationships, the tendency to overestimate one's own opportunities (both in the positive and negative directions). The difference between real and imaginary possibilities causes frustration in most life situations. The results clearly indicate that the majority of people with hypertrophic scars have low adaptive capacity and experience difficulty in adapting to the social environment.

The results confirmed the hypothesis as to the presence of symptoms of psychoneurotic disorders in the majority of patients with head and neck scars arising from the existing cosmetic defects. In our opinion, they serve as an additional factor in the complications of the disease, and chronic stress and depression can cause an imbalance between the components of the immune response. Therefore, the need

for psychological rehabilitation of patients with head and neck scars is obvious.

Thus, a comprehensive examination of patients with hypertrophic scars of the head and neck, which implies the use of non-invasive diagnostic method RGB-visualization of scar tissue and evaluation of emotional status, in our opinion, will provide the optimal choice of methods for treatment and achieving the maximum therapeutic effect.

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