

UDC 615.825/616-001.17

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Application of medical physical culture at extensive superficial burns of the I–II degree

Abstract. Purpose: to study and prove purpose of medical physical culture at extensive superficial burns of the I–II degree for normalization of exchange processes, the prevention of the developments of stagnation connected with the compelled decrease in physical activity. **Materials and Methods:** analysis and generalization of scientific and methodical literature. **Results:** the main means of physical rehabilitation – medical physical culture is considered; its application at treatment of patients with extensive superficial burns of the I–II degree is proved; techniques of medical physical culture in the period of little burn shock and in the period of a sharp toxemia are described in detail. **Conclusions:** it is established that occupation duration remedial gymnastics depends on a condition of the patient and objectives. In each occupation the all-strengthening, breathing and special exercises, as a rule, have to be applied. The most important feature of a technique of occupations at a burn disease is need of repeated performance during the day of the special exercises directed on prevention or elimination of malfunction of the musculoskeletal device.

Keywords: physical rehabilitation, superficial burns, medical physical culture, burn shock, sharp toxemia.

Introduction. The relevance of a problem of a burning injury is defined by the considerable frequency of a defeat as adults, and children, the complexity and duration of a treatment, the long disability and rather high lethality of victims [7]. The damage of issues of an organism resulting from a local action of high temperature, and also chemicals, electric current or ionizing radiation are called burns. Scales of a defeat by burns increase continuously around the world for the last decades. According to data of WOH, thermal defeats take the third place among other injuries, and in some countries, for example in Japan, – the second place, conceding only to transport injuries. To some extent it is explained by a high installed power of modern production, transport, a wide use of high-tension currents, aggressive chemical and explosive substances. It is necessary to emphasize that till 70% of burns appear in house conditions, but not on transport and production [8; 9; 11].

A search of new ways of treatment of a burning injury and its consequences remains up to date, in particular non-drug.

At first, mosaicism of a defeat is peculiar to the majority of burns when burns of various depths are localized on various sites. The second factor defining weight of a defeat at burns is its area which is usually expressed as a percentage to the general surface of a body. The third factor influencing a severity of burns is the age. Children and old men have a skin thinner therefore similar burns cause in them deeper defeats and proceed heavier owing to physiological features of an organism. Severity of burns is influenced by a location of a burn and a state of health of a victim along with the depth, the age and the area, [8].

The four-sedate classification is accepted for the characteristic of depth of a defeat of tissues: the I degree of a burn is characterized by a damage of a blanket of a skin (epidermis) and is followed by hypostasis, reddening, morbidity; the II degree – bubbles with a transparent liquid are formed in thickness of epidermis. Burns of the I and II degrees belong to superficial, their treatment is conservative. Burns of the III degree are subdivided into degrees of IIIA and IIIB. At the IIIA degree the necrosis of tissues partially takes a growing layer of epidermis, big bubbles strained with liquid contents or already burst are observed. At burns of the I-II and IIIA degree the epithelization is possible as a growing layer of epidermis remains and therefore they heal in 1–3 weeks. Burns of the IIIB and IV degree belong to deep, their treatment is surgical [8; 10].

A burn disease develops at the superficial burns (degree I-III A) exceeding 10–12% of a surface of a body [6].

A burn disease is a pathological state which is developing as a result of extensive and deep burns, followed by peculiar violations of functions of the central nervous system, exchange processes, activity of cardiovascular and respiratory systems, endocrine frustration etc. [5; 11].

In pathogenesis of a burning disease allocate three groups of mechanisms defining its emergence and development: a) action of the most thermal agent; b) influence of wound (inflammatory) process; c) secondary disorders of activity of functional systems of an organism. A burn wound is considered as a starting and supporting mechanism of illness. The severity of a burn disease depends mainly on the area and depth of burns.

In the process of the development of a burn disease 4 main periods (stage) of its current allocate: I – a burn shock (2–3 days last) – a consequence of a painful impulsation; II – a sharp toxemia (3–12 days) – a receipt in blood of bacteria and toxins; III – septicotoxemia (a consequence of suppuration of a burn wound), lasts weeks, months; IV – a recovery. Complications of a burning disease: contractures cicatricial, osteoporosis, muscular atrophy [6].

It should be noted that the period of recovery comes, passing a stage of a burning septicotoxemia quite often under the influence of timely effective treatment [2; 11].

Communication of the research with scientific programs, plans, subjects. The work was performed according to the priority direction, determined by the Law of Ukraine “About the priority of the direction of development of science and technique” with a number 3.5. “Sciences about lives, new technologies of prevention and treatment of the most widespread diseases” within the priority of the thematic direction 3.5.29. “Creation of standards and technology of introduction of a healthy lifestyle, technology of improvement of quality and safety of food” on the subject “Traditional and nonconventional methods of physical rehabilitation at diseases of different systems of an organism and damages of the musculoskeletal device at persons of different degree of training “. Number of the state registration is 0111U000194.

The objective of the research: to study and prove a purpose of medical physical culture at extensive superficial

burns of the I-II degree for the normalization of exchange processes, the prevention of developments of stagnation in lungs which are tied with the compelled decrease in physical activity.

Research problems:

1. To study special literature on a problem of rehabilitation of patients with superficial burns and a burn disease.
2. To prove scientifically applications of a technique of medical physical culture at treatment of patients with extensive superficial burns and emergence at them I-II periods of a burn disease.

Material and methods of the research: analysis and generalization of scientific and methodical literature.

Results of the research and their discussion. One of the important components of modern complex treatment of thermal injuries is medical physical culture. On condition of timely and systematic application it is considered as the necessary mean promoting return of victims from burns to a socially useful work. Regular trainings of medical physical culture promote not only to the restoration of functionality of a patient and the increase of degree of readaptation to physical activities; under their influence treatment terms are reduced that has a great social value.

The correct combination of two major biological factors – physical activity and rest within the medical mode allows providing the best results of complex treatment, to reduce a gap between clinical and functional recovery [8].

It is known that a burn disease is followed by considerable violations of functions of vitals and systems. A long rest reduces biological activity of an organism, leading to the development of a hypokinetic syndrome. The decrease in the natural proprioceptive afferentation which support a tone of the highest departments of a brain, a prevalence of a negative interoreception from an area of a burn wound are adversely reflected in a functional condition of the central nervous system.

Opportunity to have the normalizing effect on processes of excitement and braking in a bark of big cerebral hemispheres is the cornerstone of a therapeutic action of physical exercises, promoting restoration of the conditioned-reflex communications which died away in the period of a disease. The concept of the academician P. K. Anokhin about a role of functional systems of an organism according to which there are no the isolated functional systems is of great importance in an organism in understanding of mechanisms of medical action of physical exercises at a burn disease. The structural educations making them possess exclusive mobility. It causes the possibility of formation of the making active mechanisms which are capable to restore the harmonious activity of functional systems of an organism broken in connection with an illness. The use of physical exercises allows mobilizing effectively structural formations of functional systems for the achievement of a medical result.

It is established by researches of the last time that the proprioceptive impulsation from the working departments of the musculoarticulate device through a reticular formation and hypothalamus renders a trophic impact not only on the functioning groups of muscles, but also on not exercised tissues of the musculoskeletal device. This circumstance explains mechanisms of trophic action of the physical exercises providing activation of exchange processes owing to strengthening of reflex and trophic influence of the central nervous system on an organism [11].

As a result of a performance of physical exercises even without the expressed strengthening of work of heart conditions of blood supply of tissues improve, there is an elimination of the phenomena of hypoxia. The role of physical exercises in activation of extra-cardiac factors of blood circulation is essential that substantially interferes with the development of a decompensation of blood circulation in patients, especially in the second and third periods of a burn disease.

The role of physical exercises is great in prevention and treatment of pneumonia at burn patients. Improving ventilation of lungs, strengthening blood circulation, physical exercises create favorable conditions for providing an organism with oxygen [4; 11].

Medical physical culture is shown to almost all patients at any localization of a burn, irrespective of the degree and the area of a defeat of tissue. The variety of clinical manifestations of a burn disease doesn't allow defining in advance all states at which medical physical culture is temporarily contraindicated. The following contraindications are allocated: burn shock, infectious complications, hepatitis, nephrite, hypostasis of lungs, deep burns of vessels and nerves, latent bleeding. In doubtful cases the issue of a purpose of medical physical culture has to be resolved only by the attending physician [1; 6, 11].

Forms of medical physical culture: morning hygienic exercises; remedial gymnastics; independent classes; gymnastics in water; health path. Mechanic-and work therapy, massage, elements of sport and outdoor games also find an application in classes with burn patients. Physical exercises prevent a restriction of mobility in joints, cicatrical and dermatogen contractures. The main reason for disability – burn hems and deformations [6; 8; 10].

The technique of medical physical culture in many respects depends on the degree and the area of a burn. Quickly passing local changes in a skin at burns of the first degree don't demand medical application of physical exercises.

At burns of the second degree a need can appear in for the exercises directed on restoration of elasticity of a skin, endurance to its pressure, mobility in joints of struck body segments after epithelization of their skin surface.

At a conservative treatment of superficial and also of small on the area deep burns of the third and fourth degrees, if the motive function is significantly not broken and the general condition of a patient remains good, classes by medical physical culture have the all-toning character. The special exercises promoting preservation of mobility in joints and to healing of the burned sites are used in them. It is recommended to begin classes from the very first days after a burn and to continue to an absolute recovery of a patient.

Gymnastic, ideomotor, applied and sports exercises and games are used in the course of classes of medical physical culture. Exercises with the local and dosed muscular tension, breathing exercises, extension exercises, on relaxation, exercises with burdening, corrective exercises, coordination exercises and in balance, exercises on a gymnastic and special apparatus and devices, elements of serial and front exercises are applied from gymnastic exercises.

The active movements in a zone of a burn are carried out with amplitude causing only a small morbidity. Extension exercises with a resistance and with special shells and adaptations (sponges, balls, pieces of a rubber of various elasticity,

expanders, etc.) belong to the active movements. The last are applied at later stages of a burn disease, at the increasing resistance of the formed hems when an impact only of the active movements becomes insufficient.

Except mobility in joints and forces of muscles, the restoration of the coordination of movements is necessary which is broken in connection with a burn.

This requirement is especially essential at burns of the lower extremities.

In the course of classes, both in a chamber, and in an office of medical physical culture, it is necessary to use various shells. They provide a necessary starting position, fixing of separate segments, a variety in classes and an emotional background, facilitate work of a methodologist.

It is necessary to apply widely the applied movements (a grab of various subjects, a clothing of clothes, a letter, a combing, a sewing etc.) and sports exercises (walking, climbing, elements of sports, walking on skis), especially in the conditions of out-patient and sanatorium treatments.

Duration of classes by medical physical culture is various: from 3–5 till 40 and more minutes.

The physical exercises which are applied as means of restoration after burns are necessary to be repeated many times. For this purpose also independent classes of patients on the instructions of a rehabilitologist are used during which it is necessary to pay special attention to exercises with various equipment (like pedal devices, rocking chairs, expanders, balls), and also to the elementary household movements [4].

Hyperkinesotherapy gives a good effect at burn patients. The performance of exercises in a heat bath (36-38°C) allows using the small force of atrophied muscles and that to promote the prevention of different types of contractures [9].

The choice of exercises depends also on the localization of burns and on the violations caused by them [4; 7].

V. A. Vasilyeva recommends beginning at burns, first of all, from the functionally favorable laying of the burned patient's extremities. On the elimination of the phenomena of a burn shock a respiratory gymnastics is appointed to a patient that he has to repeat during a day repeatedly. The performance of physical exercises needs to be begun in joints of the uninjured extremity, with a gradual involvement of joints which skin surfaces are burned. In the first days only the active movements are applied; in the subsequent for the achievement of bigger amplitude of movements in joints the help of a rehabilitologist is admissible. The emergence of fine-pointed hemorrhages on the burned skin surfaces isn't contraindication for carrying out classes. A small pain is admissible in the course of a performance of physical exercises.

Classes with patients are given during a day 2–3 times, in the first days shortly – 10–15 minutes, with frequent pauses for rest, and further duration of classes extend till 25–30 minutes. At emergence of pains during classes it is recommended to apply the distracting exercises. In intervals between classes the methodologist has to give to the burned extremity the situation in a joint that bent, unbent, considering localization of a burn. It is expedient to carry out physical exercises for the development of mobility in joints in the water environment (bath) during processing of the burned surfaces.

Elements of work therapy are applied at patients with burns of a hand (a grab and a rearrangement of various small subjects, a molding from plasticine and a warmed-up paraffin, knitting, etc.) [2].

Tasks and techniques of medical physical culture are also defined by the period of a burn disease and a condition of a patient.

When carrying out classes it is necessary to observe the general methodical principles (sequences, systematicity, regularities etc.), considering the general and local impact of exercises on a patient's organism.

Medical physical culture is appointed from the first days after a trauma (in the absence of contraindications) and continued to an absolute recovery. Absolute rest remains at heavy and average weight of shock, deep burns (danger of bleeding), and sepsis.

The easy all-strengthening, breathing exercises and careful active, not followed by pain, with a small number of repetitions, small on volume and short (2–10 min.) movements in the burned departments are shown in the I period of a burn disease. As the general condition of a victim remains still heavy, as a rule, only breathing exercises for the prevention of pneumonia are shown at this time. Static breathing exercises with emphasis on an exhalation (a breath through a nose, an extended exhalation through a mouth), repeatedly repeating them are applied during the day [3; 11].

The all-toning exercises (with a minimum loading), breathing exercises and carefully carried out active movements in the burned sites of a body raise a vascular tone and improve an action of the heart due to the stimulation of motor- and vascular and motor-cardial reflexes. The happening at the same time activation of motor-pulmonary reflexes is one of the measures of a fight against the hypostatic phenomena and atelectasis in lungs. The special breathing exercises mobilizing the mobility of a belly wall make active also the motility of intestines. The moderate increase of an exciting tone of a bark of big cerebral hemispheres happening under the influence of exercises promotes the gradual reduction of the postshocked braking and normalization of homeostasis, the reduction of expressiveness of reflex protective contractures. In it the small movements on volume by the struck body segments can play a special role. At expressiveness of the postshocked phenomena in order to avoid their aggravation on the one-two first classes it is necessary to be limited to use of breathing exercises [4].

At the initial stages of the development of a burn disease the special attention needs to be paid also to a position of a patient in a bed (a treatment by a situation). At first the victim accepts a pose which reduces a pain, but thus situation, vicious and unprofitable for a functional treatment is created, as a rule, (reduction of a hand to a trunk, bending in large joints, etc.) as gradually it is fixed also the contracture in process of healing of wounds and development of scarring turns in dermatogen, muscular or tendinous. So, for example, burns in a shoulder often cause the bringing contracture in a shoulder joint therefore from the first days after a burn the shoulder is given the provision of the maximum assignment. At hand burns the subsequent their laying is necessary after a performance of exercises on cultivation of fingers [8–10].

Problems of MPC in a stage of a sharp toxemia:

- 1) normalization of activity of the central nervous system, cardiovascular and respiratory systems;
- 2) prevention of complications (pneumonia, thrombosis, intestines atoniya);

- 3) improvement of trophic processes in the damaged fabrics;
- 4) preservation of mobility in joints of the damaged body segments;
- 5) prevention of malfunction in not affected extremities (prevention of contractures, atrophies of muscles, pulling together hems) [2; 8; 11].

Special breathing exercises, special exercises to treatment of complications and exercises promoting healing of wounds and preservation of movements in the struck parts of a body are applied in the II period of a burn disease [3].

As a body temperature only occasionally happens high (39-40°C) during this period and is more often in the evenings, the appointment of medical physical culture is quite justified. However the general physical activity has to be minimum, it is necessary to avoid the hard-coordinative exercises, delays of breath and straining effort. Very important role is played by special exercises for the struck body segments; functional loading allows preventing the development as reflex (painful) restrictions of movements in joints, and restrictions which cornerstone pathologic-anatomic changes are. The most frequent type of damages of joints at burns of extremities – are cicatricial dermatogenetic contractures which are combined with mio- and artrogenetic approximately in 25% of cases. Postburn hems and deformations are the main reason of disability of the burned.

In the early period of a burn disease the dysfunction of joints in the form of rigidity is connected with the wrong position of the patient in a bed, with adynamia in joints as a result of dietotherapy. Such rigidity isn't a true contracture yet, however permanent violations can develop in a joint at long situation without movements. This circumstance predetermines a need of early and systematic performance of special exercises for the prevention of the development of contractures. To reduce the pain connected with a performance of movements it is recommended to carry out the active movements in a bathtub with warm water from the improved starting positions, applying the inclined planes, hammocks to suspension of extremities, etc. It is necessary to use widely exercises in relaxation of contracted muscles. A static stress of muscles, a parcel of impulses to the movements of symmetric sites of a body, and also ideomotor exercises are applied at impossibility to carry out the movements by the struck segments of a body. Early and persistent performance of special exercises promotes healing of burn wounds, prevents the development of contractures and muscular atrophies [1; 10].

In the second period of a burn disease breathing exercises gain extremely important value as means of a fight against the development of hypostatic pneumonia and violations of bronchial passability. Depending on the localization of a burn on a forward surface of a body (a breast, a stomach) the preference is given to diaphragm, or chest, to breath type with emphasis on an exhalation. The efficiency of breathing exercises increases when using plastic tubes from 500 to 800 ml. At a breath through an additional "dead" space also muscles of a neck, a breast, a stomach and a back that causes the increase of energy expenditure function and eliminates the hyperventilation phenomena arising at deep breath at rest. This exercise – a breath through a tube – needs to be carried out several times a day. A diaphragm breath with an extended exhalation and breath through a tube considerably improve the ventilation of the lower departments of lungs where most often there is a hypostatic pneumonia.

Classes have to be given with extra care and observance of the methodical rules accepted at classes with the patients suffering from chronic insufficiency of blood circulation of the corresponding stage. Owing to muscular weakness of exercise it is recommended to carry out from the improved starting positions. Performance of exercises in a heat bath (36-38°C) allows using the limited force of atrophied muscles. Remedial gymnastics in water can be carried out with patients after electrocardiographic researches, at satisfactory indicators of the electrocardiogram. The technique of remedial gymnastics in water consists in serial use of simple active and passive exercises.

The instructor who works with this contingent of patients has to be highly qualified, have profound knowledge about the changes happening in the patient's organism, and be able to select creatively necessary exercises, to be friendly, sensitive and sympathetic in relation to patients [11].

The large role in the increase of activity of the patient plays the accounting of efficiency of classes. Systematic carrying out the elementary functional and anthropometrical researches gives to the patient an evident idea of the positive changes happening in an organism under the influence of classes.

A treatment of such serious complication as a cicatricial contracture, demands a regular repeated performance of special exercises during the day for the increase in volume of movements in joints. A treatment is applied by the provision ("laying") for fixing of the reached result. The extremity keeps within in a functionally advantageous position; freight (salt, sand) weighing from 1 to 3 kg from above is put on bending or extension. This procedure lasts 8–10 min. In the process of the increase in amplitude of movements in a joint freight also increases. The repeated alternation of these procedures with mechanotherapy, hydrokinesotherapy allows reaching good results with cicatricial contractures and rigidity in joints [1].

Conclusions:

1. Various localization of a burn, unequal depth and the area of defeat, the variety of individual clinical manifestations of a burn disease don't allow using any standard complexes of remedial gymnastics in clinic. Even a selection of special exercises at identical localization of a burn has to be strictly individual, considering concrete violations of functions at this patient. One of the essential features of carrying out classes by medical physical culture with burn patients consists in it.

2. Medical physical culture is appointed at once after the patient's exit from a state of shock. At this time only breathing exercises are shown, as a rule. Early application of means of physiotherapy exercises – the best prevention of complications. Physical exercises raise a vitality of the patient, intensify blood circulation. Their role is great in prevention of pneumonia: improving ventilation of lungs, they create favorable conditions for providing an organism with oxygen. Long rest aggravates weight of a condition of the patient. Often, about three months and more, they are in inactive situation that leads to emergence of contractures of joints and muscular atrophies not only in affected areas.

3. In the second period of a burn disease when the toxemia phenomena develop, the physiotherapy exercises solve the following problems: normalization of activity of the central nervous system, prevention of complications from internals, improvement of trophic processes in the damaged tissues, preservation of mobility in joints of the damaged segments of

a body and prevention of violations in the intact. In the period of a sharp toxemia of a burn disease first of all the toning impact of physical exercises is used for the purpose of normalization of a homeostasis. Special breathing exercises are widely applied to prevention of pneumonia. However they should be cancelled at considerable rise in temperature and for the sharp course of complications from a liver, kidneys, a digestive tract, etc. (according to the corresponding indications) The special exercises which are necessary for treatment of complications are included in addition at renewal of classes.

4. Classes by remedial gymnastics as the main form of medical physical culture at a burn disease have the standard construction (introduction, main and conclusion). The duration of classes depends on a condition of the patient and objectives. In each class the all-strengthening, breathing and special exercises, as a rule, have to be applied. The most important feature of a technique of classes at a burn disease is a need of the repeated performance of the special exercises which are directed on prevention or elimination of malfunction of the musculoskeletal device during the day. The task of the instructor consists in explaining to the patient that successful restoration of movements in joints in many respects depends on its active relation to classes by medical physical culture.

Prospects of further researches. The studying and foundation of an application of medical physical culture at deep burns of the IIIB-IV degree are perspective.

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Received: 15.09.2015.

Published: 31.10.2015.

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