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Issue Article

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EFFECT OF LOW-LEVEL LASER THERAPY ON THE HEALING OF IIIAB–IV DEGREE BURNS

Abstract: *Long-term existence of extensive burn wounds leads to the development of a complex symptom of burn exhaustion complex, against the background of which purulent inflammation of the joints occurs. Low level laser therapy is a new technique used for the treatment of burn wounds. The present study current laser radiation based methods for purulent arthritis prevention. We analyzed the results of treatment of 46 patients with burn injuries of lower extremities IIIAB–IV degree being treated in the Burn Department of the Centre of Emergency Medical Care (RCSUMA) Samarkand, Uzbekistan between 2020 and 2023. In the process of observation, not a single patient had any clinical signs of purulent arthritis. Early intervention with laser treatment is a promising path in arthritis prevention. While more research remains to be done, emerging studies and practices provide increasing support for its use treatment for patients.*

Key words: *laser, therapy, emergency medical care.*
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Introduction

According to the National Center for Health Statistics Emergency Department report, one person will sustain an injury due to a fire every 23 min and approximately 433,000 burn injuries result in emergency medical attention every year in the United States [1]. Those with significant burns suffer not only directly from the injury, but also from a systemic response of suppressed immune function, increased susceptibility to infection and sepsis [2]. Lasers are now playing an important role in wound of burn management. Delayed wound healing, coupled with increased metabolic demand and a weakened immune system, predisposes these patients to infections, sepsis and can lead to the development of purulent arthritis of the joints of the lower extremities during hospitalization. Purulent arthritis is a pathological condition in which the joints of the body get inflamed as a result of bacterial infection. Despite the frequency and severity of purulent arthritis in burn injury, the number of publications on this issue is minima [3]. After a burn injury, the primary damage is to the skin, making treatment of injured skin the prioritized target for acute care. Burn injury causes profound disturbances in all organs and systems of the body [4]. Long-term existence of extensive burn wounds leads to the development of a complex symptom of burn exhaustion complex, against the background of which purulent inflammation of the joints occurs [5].

The aim of the present study was prevention development of purulent arthritis in burn patients with lower extremities.

Materials

During 4-years period, 46 patients with burn injuries of lower extremities IIIAB–IV degree being treated in the Burn Department of the Centre of Emergency Medical Care (RCSUMA) Samarkand, Uzbekistan between 2020 and 2023. All patients had a septic condition. The causes of burns were: flame – 31 (67.3 %), scald burns – 8 (17.5 %), and others –7 (15.2 %).

All patients received comprehensive general and local treatment included necrotomy, necrectomy and 1 to 3 operations were performed to plastically close deep and large burn wounds.

Methods and Results

For the study we used apparatus "MUSTANG‑2000" with a power output of 50 mW and a wavelength of 830nm.Depending on the location of pain and edema in the area of the joints of the lower extremities, laser radiation was directed at painful points in the affected joint regions. As a rule, laser exposure was applied from several directions to the joint areas. Since this is a lesion size of 1 cm2 were determined five points of application with the intention to cover the entire length of the burned area. The method of application of the laser was point contact in five different points of application, four of which were located on the edge of the injury and the last one was located in the central region. Device parameters were set individually. The duration of one session did not exceed 10–15 minutes. The treatment course included 8 to 10 procedures sessions every days. An essential condition for the success of therapy was limiting mechanical stress and restricting movement in the inflamed joints in accordance with the prescribed regimen. Patients were instructed not to bear weight on the injured limb (using crutches and fixation bandages) and to follow other recommendations of the attending physician. Laser therapy was carried out in combination with pharmacological agents. On the 2nd, 4th, and 7th days after injury, tissue samples were surgically obtained from the wound margins using special cutting instruments to monitor and analyze the epithelialization process. The collected samples were examined using histological and immunohistochemical methods.

During follow‑up, the wound healing process was monitored in all cases. Changes were recorded on the 2nd, 3rd, and 10th days after injury. Images captured on each day were compared with those obtained on the first day. Using specialized software, wound dimensions were accurately measured in pixels, analyzed, and the rate of wound closure was calculated. In addition, micromorphological examinations were conducted, and epithelial coverage of the wound surface was dynamically assessed using serial tissue samples.

Discussion

Low-power laser therapy has been used to control pain in different musculoskeletal conditions. Despite its widespread use, the results of the experimental and clinical studies are conflicting.

Since the results of low power laser therapy effectiveness studies in of post‑burn arthritis show considerable variation, we aimed to evaluate the effect of low power laser treatment in patients with of arthritis present study.

This study showed that the use of different fluences consequent emente differences energies totals, in the same wavelength, provides the healing process stimulus and different tissue responses. Currently are contradictory, since current studies show that values close to 20 J/cm2, are capable of inducing the best effects on stage of inflammation and proliferation, and stimulating angiogenesis process [6], which could be evaluated in our work.

Studies investigating the action of on III-IV degree burns, emphasize that the action of laser light is capable of accelerating the process of tissue repair by changing the cellular environment, improving the vascular formation, and stimulating the production of fibrin, synthetic collagen and the conversion of fibroblasts in myofibroblasts, which directly acts the retraction of wound edges [7,8].

In Uzbekistan sandal burns are of special interest. Most patients undergo sandal burns, particularly the children aged 6 months to 3 years. Cases of sandal burns are more frequent during winter time when people in distant mountain regions use an inappropriate heating system such as the sandal. Most of the patients with sandal burns have upper- or lower-limb injuries [9, 10].

The principal distinction from many recommendations in the field of low‑ intensity therapy lies in the rational use of low doses of laser radiation [11]. No complications were observed, and positive outcomes were achieved in 80–85% of cases. The duration of hospital treatment for patients with deep burns, as well as the time required for preoperative preparation and surgery was reduced. No cases of post‑burn arthritis were observed. Furthermore, this approach contributes to a deeper understanding of the mechanisms of laser radiation effects at systemic, organ, cellular, and subcellular levels.

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