

# Assessment of the Results for the Treatment of the Combined Soft Tissue Wounds with Ozone in the Maxillofacial Region

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**Abstract.** The combined injuries of maxillofacial region make up special place among the bones and tissues of the human body as a result of its functional and cosmetic importance. Soft tissue wounds of the maxillofacial injuries have number of distinguishing features that differs from traumas of the other parts of the organism. In this article the number of information given about physical, chemical features of the ozone and its influence for the healing of the combined soft tissue wounds of the maxillofacial injuries.

**Purpose.** Study the influence of the ozone for the healing process of the combined soft tissue wounds of maxillofacial region and assessment of the effect of the ozone for the epithelialization process of the soft tissue wounds of the maxillofacial region.

**Research material.** The essence of the research comprises the results of the investigation of the 62 examined and treated patients with combined soft tissue wounds of the maxillofacial region who is applied ozone and traditional methods of the treatment.

**Results.** A comparative evaluation of the results of the treatment of the combined soft tissue wounds of the maxillofacial region with the use of ozone and other ordinary traditional methods of treatment such as chlorhexidine bigluconate is carried out. This modified new method of treatment of the soft tissue wounds with ozone has following advantages: accelerates the period of healing process, improves phagocytosis activity of the defensive cells, increases migration of epithelial cells, activates fibroblasts and synthesis of the collagen. It is necessary to consider that intravenous infusion of the ozone with sodium chlorine is more effective than application of ozone gas itself to the injured region. In addition to this, the area receives even more oxygen in the process of application ozone water with ozone olive oil.

**Conclusions.** Thus, treatment of the combined soft tissue wounds with the use of ozone is more effective than traditional methods of treatment. The process of epithelization started earlier among the patients who received intravenous ozonized sodium chloride infusion and application of ozone olive oil rather than traditional ways of treatments

**Keywords:** ozone, healing process, soft tissue wounds, combined injures, maxillofacial region.

**Relevance.** The healing of soft tissue wounds in the maxillofacial region is a complex and sequential process. In this case, together with the environment around the wound, the health of the entire injured organism changes [1.4.5]. Trauma is a violation of the integrity of the skin and mucous membranes. In surgical practice, trauma has its own complex clinical problems, and its early and late complications can also be observed. This can lead to long-term illness and even death.

One of the factors affecting the delay in the healing of wounds in the maxillofacial region is a decrease in the supply of oxygen to the wound [2.5.4]. In this case, ozone therapy is an effective method of treating soft tissue wounds in this area, since ozone has anti-inflammatory, antibacterial, antiviral, immunomodulatory and analgesic effects [2.7.8]. Today, most surgeons are interested in the treatment of soft tissue wounds with natural physical factors and chemical substrates, and ozone is one of them. Ozone has a very good biological effect on the body, therefore it is used in medical practice [6.9.10].

**Purpose.** To study the effect of ozone on the healing of soft tissue wounds in the maxillofacial region and to evaluate the effect of ozone on the epithelialization of combined wounds in the soft tissues of the maxillofacial region.

#### **Material and research methods.**

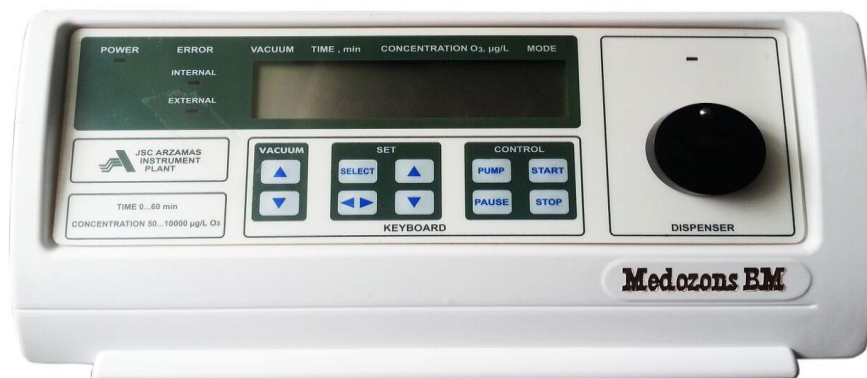
62 patients of adult age (17 years and older) with infected and clean wounds of soft tissues of the maxillofacial region were examined. To obtain comparative results, the patients were divided into 3 groups.

№	Treatment	Number of patients	Total number of patients
1 control group	Traditional - generally recognized method of treatment with the treatment of the wound area with chlorhexidine bigluconate solution 3-4 times a day	22 patients	62 patients
2 main group	Treatment of wounds with ozonated saline solution, douching of ozonated olive oil and infusion of ozone oxygen gas around the combined wounds of the soft tissues of the maxillofacial region.	20 patients	
3 main groups	intravenous drip infusion of ozone therapy and treatment of wounds with ozonized sodium chlorine solution, applications with ozonized olive oil.	20 patients	

1 control group of patients included 22 people who received the traditional, generally recognized method of treatment with the treatment of the wound area with chlorhexidine bigluconate solution.

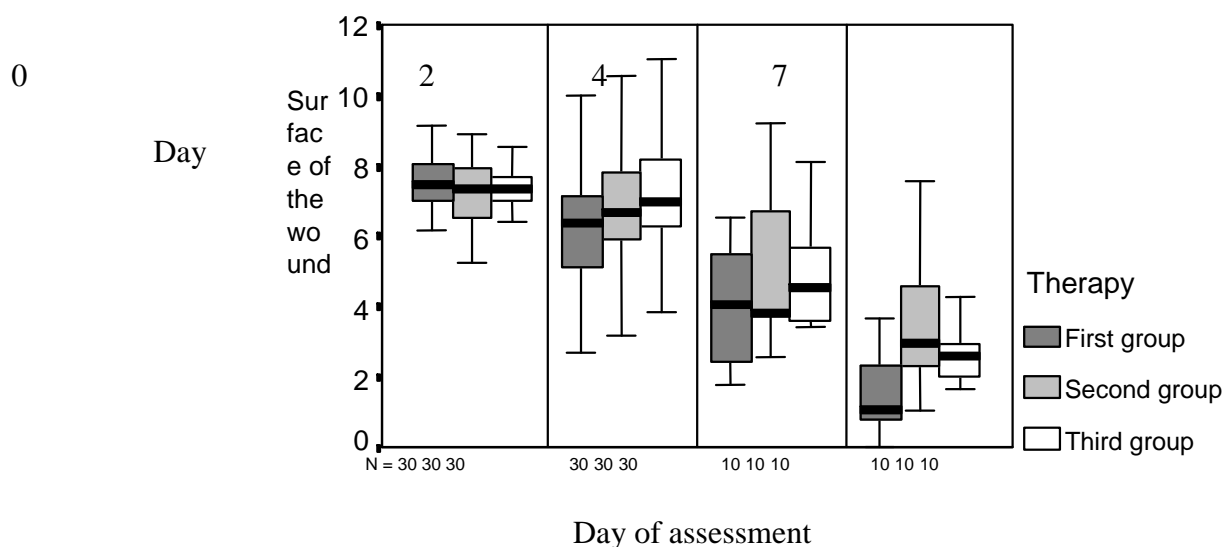
2 main group consisted of 20 patients who received treatment of wounds with ozonized saline solution, douching of ozonated olive oil and infusion of ozone oxygen gas around the combined wounds of the soft tissues of the maxillofacial area.

3 main group included 20 patients who received intravenous drip infusion of infusion ozone therapy and treatment of wounds with ozonized sodium chloride solution, applications with ozonized olive oil.



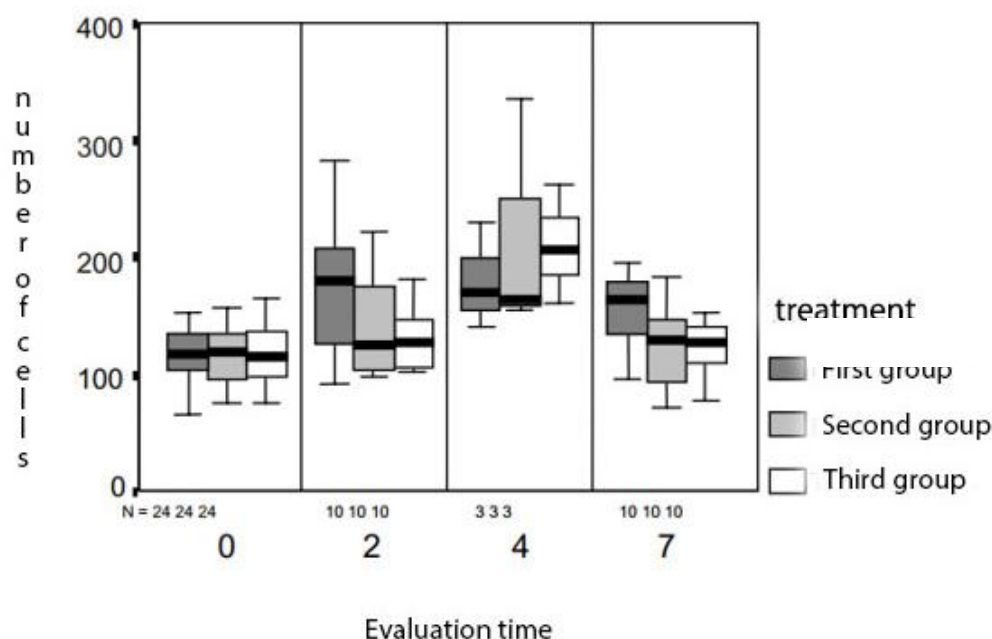
The device Medozons BM-03 was used to obtain ozonized gas, saturation of physiological solution and olive oil with ozone. Treatment began immediately after receiving damage to the soft tissues of the maxillofacial area and was carried out daily at the same time. After 2, 4 and 7 days, the edges of all wounds were surgically removed with a diameter of 6 mm. The preparations were examined histologically and immunohistochemically. Exclusion criteria were associated with immunodeficiency factors, smokers, pregnant women, and patients with coagulopathies.

All wounds were monitored by a special camera to determine the healing process. The change in this process was recorded immediately after injury and compared from 2.3 to 10 days after receiving wounds of the maxillofacial area. The entire period of wound healing was recorded in the chamber and compared with the size of the 1st day of the wound. A special computer program is used to measure the size of the wounds in pixels and the final dimensions are calculated using the size of the reference in pixels.



**Fig. 2: Wound area / mm<sup>2</sup> depending on the day of assessment, type of treatment and number of wounds examined**

Micro morphological examination was also carried out. The coverage of the wound surface by the proliferation of epithelial cells from the wound border was analyzed in dynamics. At the second stage, the presence of mitosis in the newly formed epithelium was refined using existing cell markings.

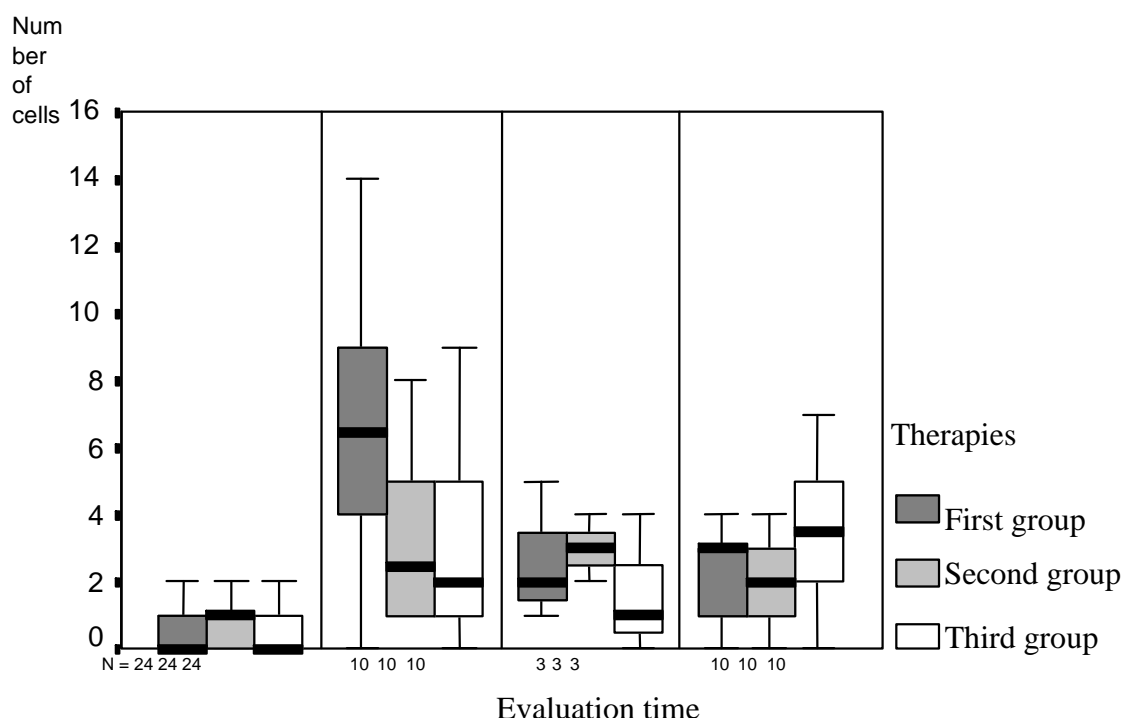


**Figure. 3 The area of the marked cells on the counting line depending on the days, in the form of treatment and the number of wounds examined**

## Results.

Comparative evaluation of the treatment of soft tissue wounds in the maxillofacial region with 1 control and 2 main groups of patients showed that the use of ozonized saline solution at a concentration of 1800-2000  $\mu\text{g} / \text{l}$  has an effective bacteriological effect that exceeds the corresponding effect of chlorhexidine.

The results of new methods of treatment show a high clinical efficacy of intravenous drip infusion of ozone therapy and treatment of wounds with ozonized sodium chloride solution, application with ozonated olive oil. Patients felt an objective and subjective improvement: performance.



**Figure: 4: The number of cells undergoing mitosis on the counting line depending on the day of assessment. type of treatment and number of wounds examined**

Recovered, the body temperature returned to normal and the state of health improved. The statistical evaluation showed that in the control groups of patients, treatment had a much weaker effect on reducing the wound surface ( $p = 0.16$ ) than in the main groups of patients. On the 7th day after damage to the soft tissues of the maxillofacial region, 8 out of 10 wounds in the 3rd group of patients are covered with epithelium, and in the 1st group only 5 out of 10 wounds are covered with epithelium. This indicates the effectiveness of different forms of ozone therapy in comparison with the traditional method of treatment.

Daily use of ozonized saline solution, treatment of wounds with ozonated sodium chloride solution, applications with ozonated olive oil accelerates the healing of soft tissues in the maxillofacial region. It should be noted the high clinical efficacy of intravenous drip infusion of infusion ozone therapy in comparison with dry ozone-air mixture. When ozonized water and ozonized oil are applied, the wound receives more oxygen. The modification of the new method of treating wounds with ozone is as follows: shortening the healing time, increasing the phagocytic activity of protective cells, accelerating the migration of epithelial cells, activating fibroblasts and the importance of collagen synthesis.

**Conclusion.** Thus, the treatment of soft tissue wounds in the maxillofacial area using ozone is several times more effective than traditional methods of treatment. The epithelialization process began early in patients who received intravenous drip infusion of ozonized saline solution and treatment of wounds with ozonated sodium chloride and applications with ozonized oil.

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