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CLINICAL EFFICACY OF A NOVEL DOSED TISSUE DISTRACTION METHOD IN THE TREATMENT OF SOFT TISSUE DEFECTS IN THE LOWER LIMBS

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ИЗУЧЕНИЕ КЛИНИЧЕСКОЙ ЭФФЕКТИВНОСТИ МЕТОДА ДОЗИРОВАННОЙ ТКАНЕВОЙ ДИСТРАКЦИИ ПРИ ЛЕЧЕНИИ ДЕФЕКТОВ МЯГКИХ ТКАНЕЙ РАЗЛИЧНОЙ ЭТИОЛОГИИ В ОБЛАСТИ НИЖНИХ КОНЕЧНОСТЕЙ

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A comparative assessment of the original method of DTD for skin defects closure in the lower limbs compared with traditional approaches has been made. 345 patients and injuries with skin and soft tissues defects of lower limbs were included in the analysis, out of which standard approaches were applied to the treatment of 164 patients, the original

method of dosed expansion was applied to 181 patients. High clinical efficiency of the DTD was proved according to results of the analysis: reduction of term of wound decontamination and recovery of index of white blood cell count, frequency reduction of local and general complications. Also reductions of surgical interference during the period of hospital stay were specified.

Keywords: skin defect, dosed expansion, lower limb, wounds closure

Проведена сравнительная оценка использования оригинального метода дозированной тканевой дистракции для закрытия дефектов кожи и мягких тканей в области нижних конечностей относительно традиционных методов лечения. Из 345 больных и пострадавших с дефектами кожи и мягких тканей нижних конечностей стандартные подходы к лечению применялись у 164 пациентов, оригинальный метод дозированного растяжения тканей – у 181. Доказана высокая клиническая эффективность предложенного метода: отмечено сокращение сроков деконтаминации раны и нормализации количества лейкоцитов крови, снижение частоты местных и общих осложнений. Уменьшились длительность госпитализации и сроки заживления раны, снизилось количество хирургических вмешательств.

Ключевые слова: дефект кожи, дозированное тканевое растяжение, нижняя конечность, закрытие ран

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DTD – dosed tissue distraction

Recent studies have shown that there is no reduction in the number of patients with extensive wound defects of the lower extremities resulting from widespread necrotizing soft tissue infections or as a result of various traumatic injuries [1–5]. Such large wound surfaces require the development of effective ways in which to close them. Clinically, the most accepted treatment used to close extensive wounds is with local tissues, using techniques involving dosed tissue distraction (DTD), loose plastic with a split flap, or a combination of these methods [6–8]. However, cutaneous plasty of a contaminated wound leads to a high incidence of postoperative complications [1, 2, 8].

We have developed a new approach to treating extensive skin and soft tissue defects in the lower extremities, based on the original DTD techniques [9, 10]. No studies have yet been conducted on the clinical efficacy of this novel method compared with the standard treatment of extensive soft tissue defects in the lower extremities.

The aim of the present study was to evaluate the effectiveness of a novel DTD method in comparison with traditional surgical methods for the treatment of soft tissue defects in the lower extremities.

Material and Methods. The present study was conducted in the Krasnodar Regional Clinical Hospital № 1 named after Prof. S. V. Ochapovsky and City Hospital № 4 (Sochi) from 2008–2017. The treatment results of 345 patients with skin and soft tissue defects of the lower limbs were analyzed. The patients were divided into two groups based on the treatment method used: the control group comprised 164 patients who underwent standard treatment approaches, while the main group comprised 181 patients treated via the novel DTD method (patent № 113464 of 20.02.2012, and patent № 117285 of 27.06.2012).

The two groups were comparable regarding patient age and clinical characteristics. The mean patient age was 50.9±1.3 years in the main group, and 48.8±2.6 years in the control group. Both groups contained predominantly males, with males comprising 63.4 % of the control group and 58.6 % of the main group. The mean skin defect area comprised 1.75±0.28 % of the body surface area in the control group, and 1.81±0.35 % in the main group. The most common diagnoses were long-term compression syndrome (23.3 % of patients in the control group, and 21.5 % in the main group) and purulent wounds (22.0 % of patients in the control group, and 24.3 % in the main group). Joint endoprosthetics were inserted in 12.2 % of patients in the main group, and 10.4 % in the control group. Polytrauma, gunshot wounds, and wounds obtained from mine explosives were observed in 20.7 % of the control group, and 21 % of the main group. Necrotizing soft tissue infections were less common, occurring in 15.8 % of cases in the control group, and 12.2 % in the main group.

Patients in the control group were treated using traditional surgical wound treatment. The wounds were closed via the application of secondary seams (early or late) or with autoplasty using a loose split flap.

In the main group, the wounds were closed using a novel dermotension device and dermatension sensor, which were developed in our clinic [9, 10] (Figure). The tension force was controlled using special dermotensive sensors with a system that monitored the tension force of the soft tissue flaps. The DTD technique was carried out in stages, three to four times per day. After the removal of the apparatus, a second surgical treatment of the wound was performed.

During the treatment, the tissue condition in the wound defect area was assessed once every 3 days, and the dynamics of the course of the wound healing process and the effectiveness of the treatment were monitored via microbiological studies on postoperative days 1, 5, 7, and 10. Each patient was not discharged from hospital earlier than 5 days after secondary surgical treatment of the wound with suturing.

Descriptive statistics included the mean and the standard deviation. The reliability of the differences between the qualitative indices of the compared groups

was determined using the χ^2 test to compare the frequencies of the binary feature in two unrelated groups of paired comparisons. The nonparametric Mann – Whitney U-test was used to assess the differences between the two groups in the values of quantitative variables.

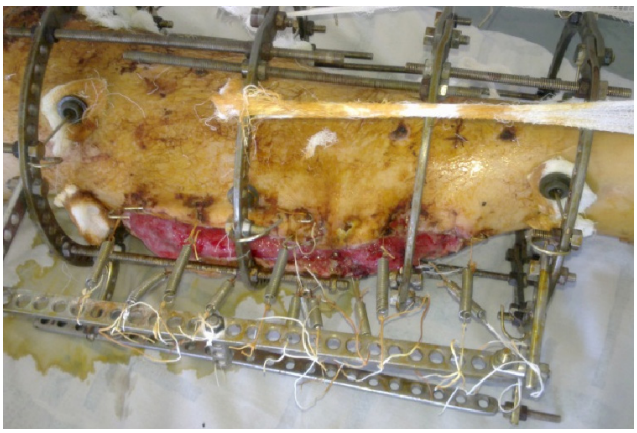

Fig. Attaching the springs to the external fixation device. The power mode was adjusted to attain the optimal degree of tension in various parts of the wound surface to enable the occurrence of a natural regenerative process with dermatension

Results and Discussion. The duration of treatment was significantly shorter in the main group (22.5±1.0 days) compared with the control group (30.4±1.2 days; $p<0.05$). The proportion of patients in the main group who underwent one to two operations after treatment was 35.4 %, which was significantly higher than in the control group (16.5 %; $p<0.05$). However, patients in the main group were significantly less likely to undergo three to five interventions (44.8 % in the main group vs. 56.1 % in the control group; $p<0.05$). Furthermore, significantly fewer patients in the main group underwent more than five operations (19.9 % in the main group vs. 27.4 % in the control group; $p<0.05$).

Common complications developed in 22.0 % of patients in the control group, while complications occurred in significantly fewer patients in the main group (11.6 %; $p<0.05$). Among these complications, severe sepsis was the most frequent, occurring in 19.5 % of patients in the control group, and 11.1 % in the main group. In the control group, there were two cases (1.2 %) of stroke and pulmonary embolism, whereas in the main group there was one case (0.6 %) of thromboembolism. Local complications were also significantly less frequent in the main group (5.0 %) than in the control group (11.0 %; $p<0.05$).

A study of the dynamics of the microbiological parameters of the wound being separated showed that on the first day after treatment commencement, the incidence of positive results did not differ significantly between groups (59.7 % in the main group, and 62.2 % in the control group). By the fifth treatment day, the frequency of positive results from wound swabs was 48.1 % in the main group, and 57.3 % in the control group. On the 10th treatment day, the incidence of positive results had decreased to 37.0 % in the main group, which was significantly lower than in the control group (51.8 %; $p<0.05$).

On days 1 and 3, the levels of leukocytosis were similar in both groups (white blood cell counts ranged from 9.5 to 10.9×10^9/L). By day 14, the white blood cell count in the main group had decreased to $7.1\pm0.2\times10^9$/L, which was significantly lower than that in the control group ($9.2\pm0.2\times10^9$/L; $p<0.05$).

DTD causes dermogenesis activation to take place, and the tension stress has a stimulatory effect on genesis and tissue growth, which enables the use of local tissues to close the wound defect [4, 6–8]. The present results confirmed the effectiveness of this phenomenon in clinical practice. The present data agree with the results of previous studies, which also demonstrated the great effectiveness of the DTD method in the treatment of extensive skin and soft tissue defects [3, 6–8]. However, most devices used with DTD techniques do not take into account the spherical characteristics of the surface of wounds located on the limbs, which results in complications in the form of traumatization with threads of soft tissues and even a vascular bundle [7, 8].

Conclusions. The proposed DTD method effectively treated skin and soft tissue defects of the lower limbs. The proposed technique creates an acceptable degree of tension, while the spring system extinguishes vibrational movements due to shocks and impacts that can act on different parts of the wound surface, ensuring a favorable course of the wound healing process and shortening the treatment and rehabilitation periods. The sensor system provides additional objective control over the parameters of the DTD technique. The application of this method in the treatment of extensive skin and soft tissue defects in the lower extremities provides step-by-step stretching of the cutaneous-subcutaneous-fascial flap, which leads to decreased microbial contamination of the wound, accelerated normalization of the white blood cell count, reduction in the incidence of complications, and reduction in the number of days that the patient remains bedridden.

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TREATMENT OF OPEN INJURIES OF THE HAND IN CHILDREN

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ЛЕЧЕНИЕ ОТКРЫТЫХ ПОВРЕЖДЕНИЙ КИСТИ У ДЕТЕЙ

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Injuries of the hand in children and adults occupy a special place in the structure of injuries of the musculoskeletal system. For a two-year period, 70 children with open bruises were treated. Analysis of the results of treatment shows that in the operative treatment of open injuries of the brush, priority should be given to the maximum organ-preserving tactics. There should be a single algorithm for prescribing antibacterial drugs in perioperative management of open hand injuries in children.

Keywords: injury of the hand, treatment, result, children

Травмы кисти у детей и взрослых занимают особое место в структуре повреждений опорно-двигательного аппарата. За двухлетний период было пролечено 70 детей с открытыми травмами кисти. Анализ результатов лечения показывает, что при оперативном лечении открытых травм кисти приоритет должен отдаваться максимальной органосохраняющей тактике. Применение единого подхода при открытых травмах кисти у детей позволяет получить хорошие результаты лечения.

Ключевые слова: травма кисти, лечение, результаты, дети

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