

## Short Commentary

# Closed Way to Treat Burns and Evolution of Wound Coverings

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Trough out the history different materials were used as wound coverings - from the hot olive oil and wax in ancient times, membranes and animal feces in Middle Ages, hemp and cotton in the 19th century, to the linen fabric, gauze, viscose and paraffin in the early 20th century. Hippocrates had already noticed that the wound healed faster when it was stored in a humid environment, covered with leaves. By the end of the 20th century, used in the treatment of wounds treatment "under a scab." Copeland (1897), Sneve (1905), John (1910), Wallace (1947) described a method for drying the wound; Davidson (1925) described a method of using tannic acid to form a scab [1]. The concept of wound healing in the moist environment appeared in 1962, when George Winter discovered that epithelisation was happening twice faster in the moist environment. Lister was also one of the first who began to treat the wounds in the moist environment. Modified technique introduced A.V. Vishnevsky, M.I. Kuzin. Currently it is known that the presence of warm, moist wound environment affects positively on the process of tissue regeneration [2]. The most widely used bandages with different emulsions and ointments. The works A.V. Vishnevsky and A.A. Vishnevsky justified pathogenetic effect of oil-balsamic emulsion. When fresh burns it is advisable to apply oil-balsamic Vishnevsky's emulsion following composition: liquid tar 1.0; anesteziina and xeroform of 3.0; castor oil 100.0. Some surgeons close the burned surface with fibrin films [3-5]. When it is uncomplicated second-degree burn the dressings often the first and the last. Repeated dressings with deep burns make in every 5-7 days depending on the indication (soaking of bandages, pain in the wound, increasing of fever). Each re-bandaging should also begin with general or local bath of warm weak solution of potassium permanganate. With extensive burns, repeated dressings can, however, cause significant pain. So, we often have to produce them under a shallow anesthesia using nitrous oxide for it [6].

The most advanced method of closing wounds and burns is autodermaplasty, which is carried out in 80-90% of cases in the surgical treatment of patients with deep burns. Although well-adjusted technique of performing this operation, the improvement of equipment and methods for treatment of postoperative wounds,

surgeons, often face complications in the form of lysis of grafts without engraftment [7-10]. Vast area of burns and repeated operations carried out to these patients lead to a shortage of donor skin resources. One of the important problems of modern combustiology is searching of effective methods for surgical treatment of patients with deep burns over 15-20% of the body surface, when plastic closing of wounds is difficult due to the shortage of donor's own resources. Multiple residual wounds after the treatment of burns IIIab-IV degree are an indication for using of modern biopolymer-skin substitutes. Burns II-IIIa degree makes the majority of thermal lesions whose treatment is mainly carried out by conservative methods. For patients with burns II-IIIa degrees it is necessary to create favorable conditions for the epithelialization of wounds, eliminate discomfort caused by soreness during dressings, to prevent the impact of pathogenic organisms [11]. The severity and duration of the treatment of people suffered from burn injuries puts the task for developing medicine that accelerates their epithelialization. One of the options for local treatment of burn wounds with a shortage of donor skin of temporary wound coverings can be used the development and improvement of which currently remains an extremely important scientific and practical task [12]. In combustiology wound coverings play an important role in the preparatory phase granulating wounds to autodermaplasty, they contribute better engraftment of skin grafts and serve as a barrier between the wound and the environment. In addition to burns, the problem of recovery of the skin occurs at various injuries, trophic ulcers and other chronic long healing, sluggish wounds arising in the background of atherosclerosis, venous insufficiency, diabetes mellitus, connective tissue disease and radiation sickness [13]. Similar problems arise in autoimmune disorders that lead to lysis of the epidermis and mucous membranes (Lyell's disease). Since ancient times, people used materials of biological origin for the temporary closing of wounds and burns. Currently as biological wound coverings are used allogeneic and xenogeneic tissue, including donor and cadaver skin. However, the use of these materials is not widely adopted because of the high cost of their production, ethical issues, limited donor resources, a lack of

well-functioning system of «skin banks», difficulties of preparation and a limited period of storage [14]. Therefore, the problem of finding effective ways to restore the barrier between the internal environment and the external environment of human body is relevant in modern medicine. Synthetic biopolymers have advantages over traditional and biological wound dressing, since have no their drawbacks. Traditional wound dressings, such as gauze, have strong adhesive qualities. Granulation tissue can grow through the large cells of the fiber dressings. When you remove sticking dressings, you damage the newly formed epithelium, granulation and other underlying tissue with the occurrence of bleeding, which affects the delay of wound healing and the possible increase in the degree of tissue damage, which is particularly important with the border burns [15]. Just when fixing the gauze bandage on a limb with a gauze bandage in terms of increasing reactive edema may develop turnstile effect and development of ischemia. As a result of injuring to tissue with sticking dressings, the regeneration processes are slowed down, there is a risk of complications and chronic wound healing process. Also, these dressings are painful, cause discomfort and patients often require pain relief. In foreign literature, it is believed that the pain relief during dressing is a sign negatively characterizes the approach in the treatment of wounds, in particular due to the use of unmodern injuring dressings [16].

More and more scientists pay special attention to the problem of pain during change dressing. Pain at changes of dressing affects negatively the psychosomatic status of the patient, expressed in depression, fear of dressings, insomnia, loss of appetite, inactivity, anxiety and loss of independence. It was also found that regular pain nociception leads to increasing cortisol production which has a negative effect on the immune system and the production of cells growth factors and vasopressin compromising the delivery of oxygen and nutrients to the wound. Particular attention is paid to the quality of life of patients with wounds and is improvement, by noninvasive, painless dressing and enabling accelerated tissue repair. In the development of wound dressings becomes important concept of wound healing in a moist environment. Hippocrates had already noticed that the wound heals faster when it is stored in a humid environment, covered with leaves. By the end of the 20th century, the treatment of wounds «under a scab» has used. Copeland (1897), Sneve (1905), John (1910) Wallace (1947) described methods for drying the wound; Davidson (1925) described a method of using tannic acid to form a scab [17].

Bandage and cotton hitherto are used in the treatment of wounds, including burns. These dressings have a certain degree of adsorption capacity, but cannot maintain the moisture balance in the wound, leading to its complete drying. But now it is available a large number of modern, interactive wound dressings, the choice of which should be based not only on the size and type of wounds, but also on the characteristics of exudate - the origin, composition,

volume and viscosity.

Exudate is a key component in all phases of wound healing, delivering nutrients to the wound and creating favorable conditions for migration and mitosis of epithelial cells, proliferation of granulation tissue and fibroblast, migration of leukocytes, enhances local immunity and autolytic wound cleansing. In the literature, there is an opinion about the importance of exudate in galvanotaxis - maintenance of endogenous bioelectric fields that affect the movement of cells.

To assess the degree of retention moisture on the wound surface is used outside Water Vapor Transmission Rate (WVTR), reflecting the rate of transmission of water from its surface, including through the dressing. With average WVTR less 35gr/m<sup>2</sup>, collagen synthesis is increased by 5%, the intensity of re-epithelization increase by 30-50% (runs 2-5 times faster) in comparison with methods of treatment of wounds. The rate of evaporation through the damaged skin is 0.5-2.2 ml / cm<sup>2</sup> / h. The optimal rate of evaporation through the wound covering is considered an indicator of 6-12 mg/cm<sup>2</sup>. Drying of the wound leads to inhibition of keratinocyte proliferation, formation of eschar, which consists of the dried exudate and cellular debris. It serves as a mechanical barrier for migrating epithelial cells from the wound edges, and significantly lengthens the healing of wounds [18].

If the depth of the damage is limited to the papillary layer, dermal elements in the form of hair follicles and sebaceous glands, which remained after the burn, die by dehydration, thereby depriving it the possibility of healing by epithelialization insula.

Another problem in the treatment of wounds it is plenty of fluid. It is important that wound dressings not only well absorbed, but also well linked excess exudate. In complicated infections, a significant degree and for the area and as a consequence - nonhealing wounds including burn, with an increase of edema resulting from venous-lymphatic stasis, inflammatory exudate loses its medicinal properties and it is often overproduction. Exudate become aggressive to the surrounding tissue, can lead to maceration of intact skin around the wound repair and inhibition of increase in the depth and extent of tissue damage resulting from an excess of inflammatory mediators and proteinases high level. In addition, an abundance of unbound exudate, and the presence of dead tissue, do not pose a barrier to infection and create a favorable climate for the growth of bacteria [19].

It is known that burn wound immediately after the injury does not contain microorganisms as a result of their death along with the diseased tissue. Shortly after the burn, the wound begins to proliferate the bacteria (most *S. aureus*, *S. epidermidis*) are stored in the ducts of the sweat glands and hair follicles in the damaged area of the skin surface after burns. Wound infection contributes to

chronic inflammation, delayed collagenogenesis and fibrillogenesis, fewer mitotic fibroblasts slow down their differentiation into mature form, inhibits cell proliferation, reduces the migration of keratinocytes. There is evidence that wound infection increases the likelihood of scarring can cause bacteremia and sepsis. What is important is that the exudate impregnated dressings may be a reservoir of infection. Also, these dressings often have an unpleasant odor sickened relatives and caregivers and negatively affects the quality of life, leading to his exclusion. Based on the above, the effective management of exudate is an important clinical problem.

To modern wound dressings, non-invasive and having the property used in the concept of moist wound healing include hydrocolloids, hydrogels, alginates, calcium, film coatings and silicones.

In the history of using different materials used as wound coverings - from the hot olive oil and beeswax in ancient times, the membranes of animals and feces in the Middle Ages, hemp and cotton fabrics in the 19th century, to the linen cloth, gauze, rayon and paraffin in the early 20th century. Hippocrates already noted that the wound heals faster when it is stored in a humid environment, covered with leaves. By the end of the 20th century, it was used in the treatment of wounds treatment "under a scab." Copeland (1897), Sneve (1905), John (1910) Wallace (1947) described methods of drying the wound, Davidson (1925) described a method of using tannic acids for the formation of a scab. wound healing in a moist environment concept originated in 1962, when George Winter discovered that epithelization occurs twice as fast in a moist environment. One of the first who began to treat wounds in a moist environment, was also the Lister. Modified technique introduced AV Vishnevsky, MI Kuzin [20]. Currently reliably that the presence of warm, moist wound environment acts positively on tissue regeneration. The most widely used bandages with different emulsions and ointments. AV Works Vishnevsky and AA Vishnevsky justified pathogenetic effect of the oil-balsamic emulsion. When fresh burns advisable to use oil-balsamic emulsion Vishnevsky following composition: liquid tar 1.0; anestezina and xeroform at 3.0; castor oil 100.0. Applied also sintomitsinovoy, sulfidinovuyu or streptotsidnoy emulsion furatsil lime cream, fish oil and so on. Some surgeons close the burned surface of fibrin films AN Filatov. When uncomplicated second-degree burn is often a first ligation and last, t. To. Try to make it in time for complete healing of burns (8-12 days). Repeated dressings for deep burns produce every 5-7 days depending on the indication (soaking bandages, pain in the wound, increasing fever). Each re-dressing also should begin with general or local bath of warm weak permanganate solution kaliya. Pri extensive burns repeated dressings may, however, cause significant morbidity. So often we have to produce them under a shallow anesthesia using nitrous oxide for him.

The most advanced method of closing wounds and burns is autodermoplasty, which is carried out in 80-90% of cases in the surgical treatment of patients with deep burns [21]. Despite the well-adjusted equipment perform this operation, improvement of equipment and maintenance of healing techniques in the postoperative period, surgeons often face complications in the form of lysis of grafts and their neprizhivleniya. Vast areas of burns, as well as the repeated operations carried out according to the patient lead to a shortage of donor skin resources. One of the important problems of modern Combustiology is to find effective methods of surgical treatment of patients with deep burns over 15-20% of the body surface, which is holding a plastic closure of wounds is difficult due to the shortage of donor's own resources. Multiple residual wound after treatment of burns IIIab-IV degree is an indication for the use of advanced biopolymers skin substitutes. Burns II-IIIA degree constitute the majority of thermal lesions whose treatment is mainly carried out by conservative methods. Patients with burns II-IIIA degrees is necessary to create favorable conditions for wound epithelialization, eliminating the discomfort caused by painful at dressing changes, the effect of preventing the pathogenic microflora. The severity and duration of the treatment suffered from burn injuries poses the problem of development tools that accelerate their epithelialization. One of the options for the local treatment of burn wounds in a donor skin deficit may be the use of temporary wound coverings, development and improvement of which currently remains an extremely important scientific and practical problem. In Combustiology wound coverings play an important role in preparation of granulating wounds to autodermoplasty, contribute to a better engraftment of skin grafts, and serve as a barrier between the wound and the environment. In addition to burns, the problem of recovery of the skin occurs for various injuries, trophic ulcers and other chronic dlitelnonezazhivayuschih, indolent wounds that occur on the background of atherosclerosis, venous insufficiency, diabetes, connective tissue disease, radiation sickness. Similar problems arise in autoimmune disorders that lead to lysis of the epidermis and mucous membranes (Lyell's disease, and others.). Since ancient times people have used materials of biological origin for the temporary closure of wounds and burns. Currently, as a biological wound coverings applied allogeneic and xenogeneic tissue, including cadaveric donor and leather. However, the use of these materials are not widely popular because of the high cost of production.

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