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CASE REPORT
Technology

Successful Treatment Outcomes for Partial Thickness Burns by Innovative Bovine Peritoneum Dressing

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Summary: In the world practice of treating burns, acellular matrices have been used for quite a long time. However, the budget for treating one burn patient in Kazakhstan does not exceed $1000. This amount does not cover the costs for procurement of foreign-made xenograft dressings. Because the cattle breeding sector is very well-developed in the country, a domestic xenograft is produced by decellularization and sterilization of the cattle peritoneum, which costs only $10. This case report outlines how we used this matrix in a patient with partial thickness burns. A 45-year-old woman was admitted to the burn department with second stage burns on her back and right shoulder. The burn area comprised 10%, according to the Lund Browder chart. Once formal consent was obtained from the patient, an occlusive dressing was applied from the decellularized cattle peritoneum. Good adhesion of the dressing to the wound bed was noted. The patient was discharged from the hospital on the tenth day. It took 23 days to reach complete epithelialization. No adverse effects were noted. We believe that further studies conducted by our research team will allow this innovative, low-cost, easy-to-apply biologic dressing to be widely used in the therapeutic treatment of burns. *(Plast Reconstr Surg Glob Open 2022;10:e4150; doi: 10.1097/GOX.0000000000004150; Published online 24 February 2022.)*

The WHO average statistics for 2018 add up to 180,000 burn deaths. Burn injuries are predominantly found in developing countries, including Kazakhstan.[1] In world practice, biological dressings of various origins have long been used for the treatment of burns.[2–4] Moreover, each dressing shows a different degree of influence on the factors of wound healing.[5]

In Kazakhstan, the budget for treatment of burns of any location, area, and depth does not exceed $1000. In fact, this amount does not cover all the costs; therefore, it is too expensive to purchase imported biological or synthetic coatings.[6]

Cattle breeding is well developed in Kazakhstan. A cattle peritoneum is a byproduct of meat production, and is available in large quantities. This led to the development of an acellular matrix based on the cattle peritoneum as an available and affordable material.[7]

X-GRAFT is a thin, whitish film of cell-free collagen matrix. Unlike the skin, the peritoneum does not require preliminary mechanical treatment to remove wool and other surface layers.

Decellularization minimizes the antigenic properties of the tissue. The remaining collagen matrix is structurally similar to human collagen.[8]

When applied to the wound surface, X-GRAFT self-adheres to the wound with a gauze bandage applied as an additional reinforcement from outside. Thus, direct contact of the wound surface with the external environment is prevented.

These properties make it possible not to change dressings until the moment when X-GRAFT independently gets off the wound after healing. This way the patient does not experience any pain that tends to occur when changing gauze dressings.

A randomized clinical trial is being conducted to assess the clinical efficacy of the X-GRAFT wound dressing in Kazakhstan. This case report is intended to show the intermediate result and the possibility of using a decellularized cattle peritoneum as a dressing material for partial-depth burns.

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CASE

A 45-year-old woman with no comorbidity was admitted to the trauma center ER on June 29, 2020, 2 days after getting burned with some boiling water.

The doctor on duty made an antibiotic sensitivity bacterial culture test and applied sterile gauze bandages with 0.05% chlorhexidine bi-gluconate, and prescribed 1 g ceftriaxone No. 3 twice daily, which was later changed to amikacin No. 6, 500 mg twice a day intramuscularly based on the sensitivity test result.

On July 1, 2021 the patient was examined by the research team. One could observe superficial partial-thickness burns covered with exfoliating epidermis in the area of the patient's back and left shoulder, and some deep partial-thickness burns in the lower right side of the chest covered with a superficial scab in the lumbar area.[9] The total area of the burned surface according to the Lund Browder's table was 10%, 1800 cm^2 (Fig. 1).

The patient was submitted to analgesia with 100 mg of tramadol. After cleaning the lesion with 0.05% chlorhexidine bi-gluconate and removing necrotic tissue and blisters (an essential step to allow maximal contact between the biomaterial and the wound bed), 20 pieces of 10 cm^2 X-GRAFT plates were applied with an overlap of 0.5–1 cm on the healthy skin along the edges of the wound (Fig. 2). The areas were bandaged externally to prevent the X-GRAFT from coming off.

The patient's condition was assessed by the research team every 6 hours against the vital signs and clinical conditions, which remained stable throughout the observation. The gauze was changed and xenografts were also visually checked every 48 hours for the presence of exudate and apparent need for a change, none of which were detected. After X-GRAFT application, no further analgesia was needed, taking into consideration the clinical evaluation of the patient's comfort. On the second day after application, X-GRAFT completely adhered to the wound and dried out as well as a 10 cm^2 fragment of biomaterial in the lumbar area. The dressing was replaced with iodine-soaked gauze (a standard method of treatment in Kazakhstan).

On the seventh day, the xenograft dried out with the edges of the wounds contracted and opened. In the opened sections of the wound, re-epithelialized areas were visualized in the upper part, with some epithelialization spots noted at the lower part of the wound (Fig. 3). Later on, the patient was discharged from the hospital.

After the discharge, the patient received no treatment, and the wounds were not treated. On day 23 (14 days after discharge), the patient appeared for a control examination. X-GRAFT was completely off. The surface of the burn wounds was dry and clean without edema. There was a slight hyperemia of fresh skin at the lower right corner of the wound. Subjectively, the patient did not feel any discomfort, and the range of motion in the left shoulder joint was full (Fig. 4).

DISCUSSION

In world practice, the use of biological dressings of various origins is widely developed. However, the studies have shown that the use of different biological covers demonstrates different results in wound healing.[5] For example, one study has shown that when using a tilapia-based graft, the healing of similar wounds occurs on average by 18±0.99 days.[3]

Partial thickness burns with a porcine xenograft are healed by 13.22±2.1 days, and by 13.6±11.1 days in patients with mixed and deep partial thickness burns.[10]

This case shows that the patient with incomplete thickness burns was able to fully recover 23 days after xenograft application. It is obvious that such an indicator (23 days) is beyond the average indicators for other grafts. Furthermore, it is too early to assert any conclusions based on one case only. This issue requires additional research.

A xenograft is used for burns of incomplete thickness during the first 3 days after mechanical cleaning of a

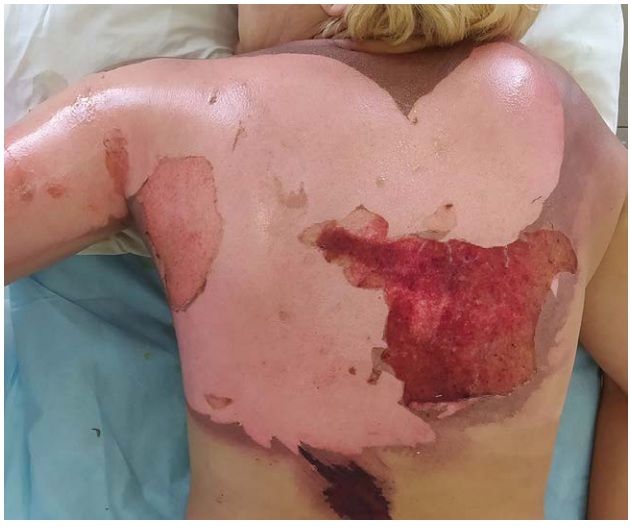

Fig. 1. Wound condition after debridement.

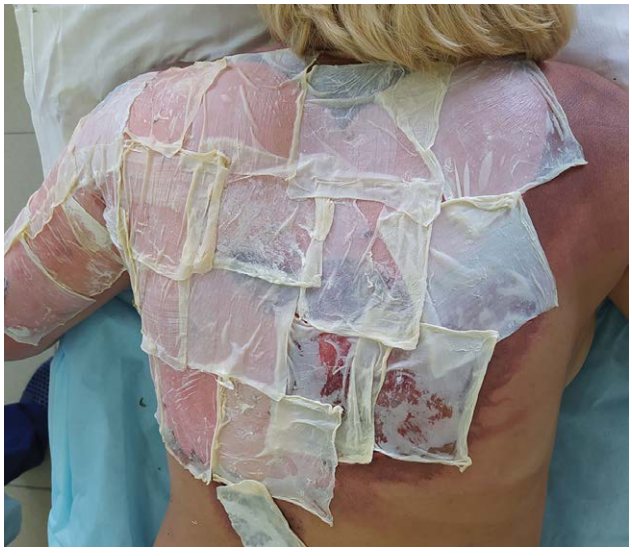

Fig. 2. Wounds after the xenograft application.

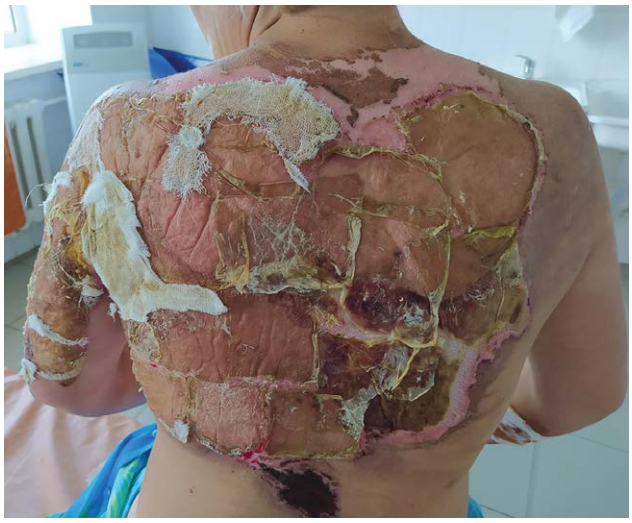

Fig. 3. The seventh day after the xenograft application. Drying of xenograft. No adhesion at the low back area.

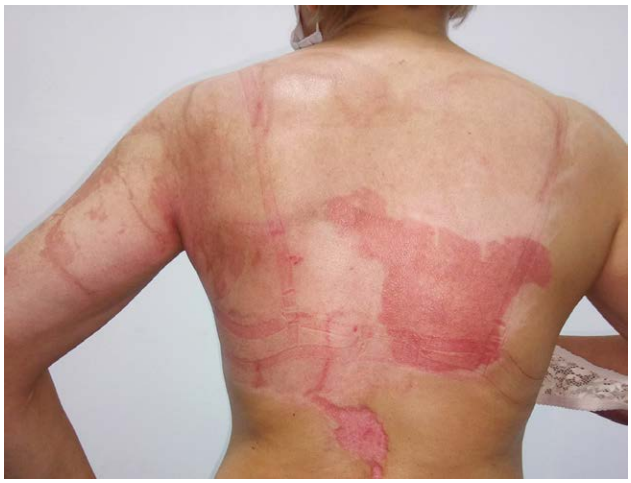

Fig. 4. The fourteenth day after discharge, and 23 days after the xenograft was applied. Complete exfoliation of the xenograft. The wound is epithelialized.

wound. Before applying a xenograft, a bacteriological culture is taken from the patient to check for any sensitivity to antibiotics. According to the sensitivity results obtained, a patient undergoes antibiotic therapy.

At the research stage, a contraindication to use is pregnancy, age under 18 and over 60 years, and individual intolerance to the dressing material.

Before use, the dressings are stored in a sterile sealed package at +5°C. The grafts have a shelf life of 2 years. The patients are only treated at the expense of the state. For the period of the research, the xenografts were provided by the manufacturer free of charge. The study was approved by the Central Ethics Commission of the Republic of Kazakhstan, in accordance with the requirements of the Helsinki Declaration.

Safety

During preparation, the matrix is completely decellularized. This allows for minimizing antigenic structures. Further on, gamma irradiation is used for sterilization. However, some risk of infection of the wound under the bandage still remains. The risk of infection is reduced by antibiotic therapy and broad-spectrum drugs. The therapy continues as per the results of bacteriological culture tests. In case of wound infection, the dressings are removed, and the wound is treated with new grafts applied.

A single experiment of using such a new technology limits the full interpretation of the data, and cannot give statistically significant results regarding its effectiveness and safety. It also does not allow us to evaluate a xenograft at the morphological level. Nevertheless, the complete rehabilitation of a patient without any complications gives hope for the prospects of this technology.

At the moment, a full-scale study of X-GRAFT by the team of the authors is coming to an end. The results of this study will fully demonstrate the efficacy and safety of the product under research.

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