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Natalia V. KHramova
Tashkent State Dental Institute, Tashkent, 100047, Uzbekistan, nhramova@mail.ru

Yulduz B. Xusanova
Tashkent State Dental Institute, Tashkent, 100047, Uzbekistan, kh.yulduz31@gmail.com

Alisher A. Makhmudov
Tashkent State Dental Institute, Tashkent, 100047, Uzbekistan, alishermah@mail.ru

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REGARDING THE REGENERATION OF SUPERFICIAL SKIN DEFECTS

Natalia V. KHramova [1], Yulduz B. Xusanova [2], Alisher A. Makhmudov [3]

1 Associate Professor, Tashkent State Dental Institute, Tashkent, Uzbekistan
E-mail: nhramova@mail.ru

2 Assistant, Tashkent State Dental Institute, Tashkent, Uzbekistan
E-mail: kh.yulduz31@gmail.com

3 Associate Professor, Tashkent State Dental Institute, Tashkent, Uzbekistan
E-mail: alishermah@mail.ru

ABSTRACT

One of the promising methods is the use of dermal fibroblasts for the treatment of skin defects. These cells are easily cultured in the laboratory without losing their functions. Due to their key role in maintaining tissue homeostasis, fibroblasts, like no other cells, are able to effectively create conditions for the proliferation and migration of other cell types. In the world, there are a number of manufacturers that produce wound coatings based on fibroblasts in an industrial way, these are TransCyte-allogeneic fibroblasts of the human neonatal foreskin associated with a silicon membrane and grown on pig collagen covering a nylon mesh. **Aim**: to evaluate the prospects and safety of using a tissue-engineered construction created on the basis of boiled silk gauze and fibroblasts for the treatment of superficial skin defects. **Materials and methods:** An experimental study was conducted to investigate the effectiveness of a tissue-engineered construct derived from bovine collagen with flavonoids from Saphora japonica with the addition of allofibroblasts to optimize the regeneration of deep soft tissue defects on the backs of rats. **Results of research:** Clinical and laboratory studies of peripheral blood of white rats were performed on the BC-3000 (Mindray, P. R. China) hematological analyzer. According to a detailed blood test, the number of red blood cells and white blood cells, Hb, color index, hemogram with counting of reticulocytes, platelets, basophils, eosinophils, rod-shaped leukocytes, segmented leukocytes, lymphocytes, monocytes, the rate of blood sedimentation etc., were studied. **Conclusion.** The results of the research allow us to conclude that tissue-engineered construction made of boiled silk gauze and allofibroblasts is safe for the health of experimental animals in case of surface skin defects.

Key words: allofibroblast, white blood cells, red blood cells, fibroblasts, color index.

INTRODUCTION

The category of patients with facial skin defects currently requires the use of high-tech medical care [4,p.57]. One of the promising methods is the use of dermal

fibroblasts for the treatment of skin defects. These cells are easily cultured in the laboratory without losing their functions. Due to their key role in maintaining tissue homeostasis, fibroblasts, like no other cells, are able to effectively create conditions for the proliferation and migration of other cell types. The data obtained to date reliably demonstrate the high clinical efficacy and safety of using fibroblasts for the correction of cosmetic defects and treatment of long-term non-healing wounds and burns. Tissue-engineered structures created on the basis of fibroblasts are of the greatest interest in the medical product market [1, p.188, 5, p.74].In the world, there are a number of manufacturers that produce wound coatings based on fibroblasts in an industrial way, these are TransCyte-allogeneic fibroblasts of the human neonatal foreskin associated with a silicon membrane and grown on pig collagen covering a nylon mesh [2]. Dermagraft consisting of cryopreserved human allogeneic fibroblasts obtained from the skin of the foreskin of newborns grown on a biodegradable polyglactin (vicryl) mesh (Potekaev N. N., Frigo N. V., Petersen E. V., 2017). The sales volume of wound cell coatings is about 1 billion rubles. dollars. An extremely important issue remains the choice of the substrate (carrier) of cellular structures, since today there is no perfectly selected structure of the cell carrier [3, p.45].

The purpose of the study: to evaluate the prospects and safety of using a tissue-engineered construction created on the basis of boiled silk gauze and fibroblasts for the treatment of superficial skin defects.

Materials and methods: An experimental study was conducted to investigate the effectiveness of a tissue-engineered construct derived from bovine collagen with flavonoids from Saphora japonica with the addition of allofibroblasts to optimize the regeneration of deep soft tissue defects on the backs of rats.

The wound-healing efficiency of deep soft tissue defects was studied in vivo on 18 mature male rats. For the study, rats with a body weight 164.83±1.608-173.33±2.32 g were divided into 2 groups of 6 individuals in each group. The animals were kept in the vivarium of the Interuniversity Research Laboratory (IRL) TMA on a standard diet, taking into account the provisions of the international convention on "Rules of work with experimental animals" (European Communities Council Directives of 24 November 1986, 86/609/EEC) After 2 weeks of quarantine, white rats were carefully examined, taking into account their appearance, motor activity and reaction to reflexes. Laboratory animals were kept in standard vivarium conditions and were on a full-fledged laboratory food ration with free access to water.

For the study, rats with a body weight 164.83±1.608-173.33±2.32 g were divided into 3 groups of 6 individuals in each group. Group 1-silk gauze +allofibroblasts; Group 2-silk gauze without fibroblasts; group 3- (control-healing without tissue-engineered construction). A model of an experimental soft tissue surface defect was created by forming a skin defect with a scalpel in the back area to the depth of the fascia using a plastic template of size 1x1cm, after preliminary shaving of the hair and treatment of the surgical field with betadine 3.0 cm

long. Then, a tissue-engineered construction (TEC) with allofibroblasts was placed in the formed defect, which was fixed to the animal's skin with sutures.

Results of research: Clinical and laboratory studies of peripheral blood of white rats were performed on the BC-3000 (Mindray, P. R. China) hematological analyzer. According to a detailed blood test, the number of red blood cells and white blood cells, Hb, color index, hemogram with counting of reticulocytes, platelets, basophils, eosinophils, rod-shaped leukocytes, segmented leukocytes, lymphocytes, monocytes, the rate of blood sedimentation etc., were studied. Analysis of the obtained data showed that in experimental animals, hematological and biochemical parameters did not have statistically significant deviations ($P > 0.05$), as from the norm, as well as by observation groups.

Comparative analysis of animal skin after decapitation determined that in the first experimental group, where silk gauze with allofibroblasts was used, the dermis with fibroblast nodules was detected (Fig. 1,2)

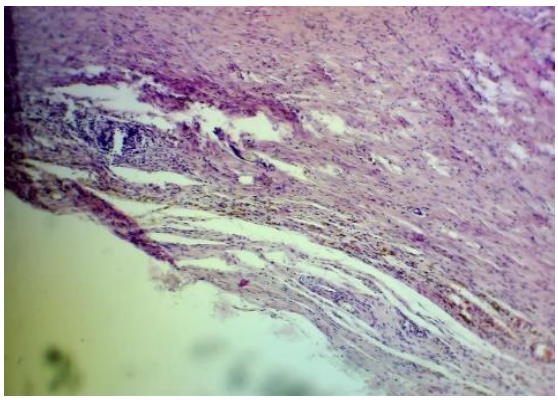

Fig.1. The first experimental group. White rat back skin. H&E stain. 10x10.

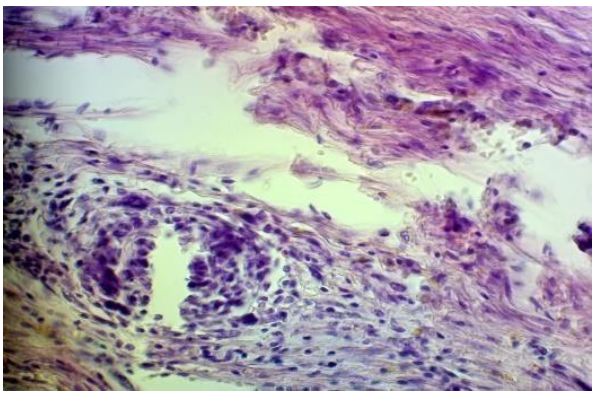

Fig.2. The first experimental group. White rat back skin. H&E stain. 10x40.

In the second experimental group, where silk gauze without fibroblasts was used, thinning of the epidermis and muscle layer with dystrophy were observed (Fig. 3, 4)

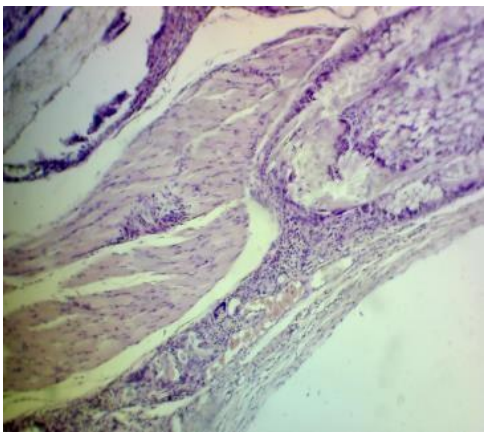

Fig.3. The second experimental group. White rat back skin. H&E stain. 10x10.

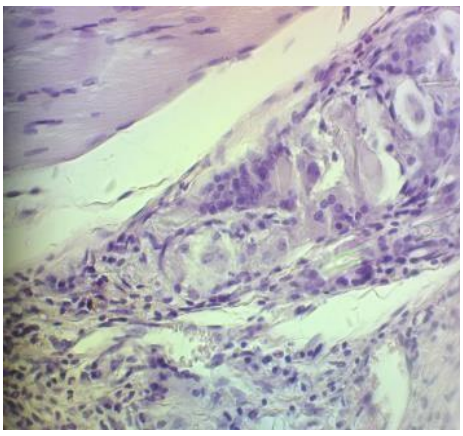

Fig.4. The second experimental group. White rat back skin. H&E stain. 10x40.

In the third control group of animals, where healing took place independently, the dermis is edematous, sebaceous glands and hair are visible, and myocyte dystrophy is also observed (Fig. 5, 6)

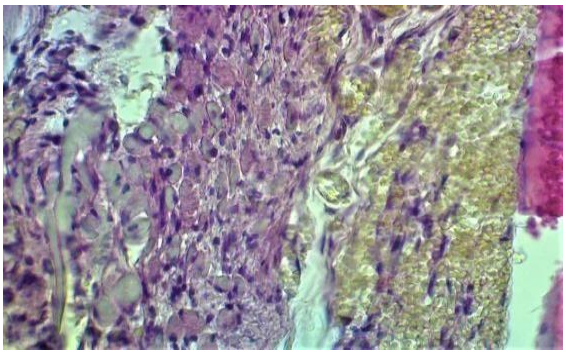

Fig. 5. The third control group. Skin of the back of white rats without covering wounds. H&E stain. 10x10.

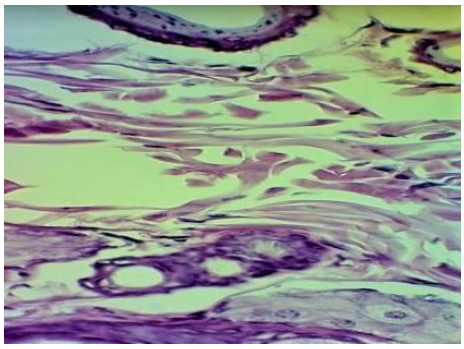

Fig. 6. The third control group. Skin of the back of white rats without covering wounds. H&E stain. 10x40.

Conclusion. The results of the research allow us to conclude that tissue-engineered construction made of boiled silk gauze and allofibroblasts is safe for the health of experimental animals in case of surface skin defects. The tissue-engineered construction, which is a two-layer bioengineered structure that contains a substrate of boiled silk gauze consisting of natural fibroin, performs a mechanical and supporting function. The second layer, formed from skin cells - fibroblasts, is an artificial analogue of the dermal layer of the skin and reduces the risk of formation of rough scar tissue. The data of an objective study of the local status of the wound indicate a positive effect when using tissue-engineered construction made of boiled silk gauze and allofibroblasts for surface skin defects. Under the influence of silk fibroin, the duration of the inflammatory-destructive phase is reduced, and allofibroblasts activate the regenerative-prooliferative phase, which leads to a reduction in the overall healing time.

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