JOURNAL OF MULTIDISCIPLINARY SCIENCES AND INNOVATIONS
GERMAN INTERNATIONAL JOURNALS COMPANY
ISSN: 2751-4390
IMPACT FACTOR (RESEARCH BIB) : 9,08. Academic research index

MORPHOLOGICAL JUSTIFICATIONS FOR THE USE OF INTRAOPERATIVE BALLOONS TISSUE STRETCHING

Madazimov K.M.

Teshaboev M.G.

Andijan State Medical Institute

Abstract: In this article, the author presents morphological changes in tissues during intraoperative balloon stretching. To confirm the adequacy of the experimentally developed method and scheme for performing intraoperative balloon stretching, the morphology of intraoperatively stretched tissues taken from patients was additionally studied. The authors revealed a rather specific reaction of the burn-affected skin of the cranial vault to its intraoperative balloon dermotension. This reaction consists of a significant increase in the number of hair shafts in the hair follicles, which is accompanied by thickening of the walls of the hair follicles.

Keywords: morphology, soft tissue, skin, hair shaft, cranial vault, scar, deformation.

Relevance of the problem. In world practice, the most relevant studies continue to be those on reducing the consequences of impaired blood flow and tissue oxygen supply during balloon dermotension [4] with optimization of hypoxic training modes, increasing tissue resistance to acute and chronic oxygen starvation [7]. Of particular interest continue to be studies on determining the technique and scheme of rapid balloon tissue stretching depending on the area of reconstruction, taking into account the morpho-functional [2] features of the soft tissues of the cranial vault, additional clinical, physiological and morphological studies [3], allowing for the development and justification of a method and scheme of rapid intraoperative tissue stretching. Of increasing interest are studies of complications of tissue stretching in post-burn alopecia [1, 5], which include divergence of the edges of the postoperative wound, rigidity of the stretched tissues, osteoporosis of the cortical plate of the cranial vault bones under the balloon, hair loss along the suture line, excess tissue in the form of skin folds during rotation of stretched flaps during subsequent plastic surgeries [6].

Materials and methods of the study. Morphological studies were conducted in the Department of Pathomorphology of the State Institution "Russian Scientific Medical Center of Surgery named after Academician V.V. Vakhidov" (Head of the Department - Professor I.M. Baibekov). Light, scanning and transmission microscopy were used. For light microscopy, samples from various areas of the cranial vault skin (a total of 22 samples) subjected to stretching, obtained during surgery, were fixed in a 10-12% solution of neutral formalin. After appropriate processing, the samples were embedded in paraffin and 5-7 μm thick sections were prepared. The general morphological picture was studied on sections stained with hematoxylin and eosin. For scanning electron microscopy (SEM), the preparations, after fixation in a 2.5% solution of glutaraldehyde on a phosphate buffer, were dehydrated in alcohol-acetone, then dried by the critical point method in an HCP-2 apparatus and sprayed with gold in an IB-2 apparatus. Photographs were taken using a Canon digital camera from the monitor screen of a Hitachi S-405 microscope. For transmission microscopy (TEM), skin biopsies from patients were immediately fixed in 2.5% glutaraldehyde solution in 0.1 M phosphate buffer pH 7.4 for 2-12 hours after excision, washed

in phosphate buffer, post-fixed with 1% osmium tetroxide solution and, after dehydration in alcohol - acetone, embedded in a mixture of epon and araldite.

Ultrathin and semi-thin sections (1 μm) were prepared from the obtained blocks on an Ultracut ultramicrotome (ReichertYong). Semi-thin sections were stained with 1% methylene blue and fuchsin. Ultrathin sections were contrasted with uranyl acetate and lead citrate solutions (UltrastainerLKB microprocessor). The study and photography of light-optical preparations were carried out using the light microscope "AXIOSKOP-40" (CarlZeiss), Germany, with a digital camera ProgRess, CapturePro 2.6, coupled with a PentiumIV computer. As a control, we used skin biopsies of the cranial vault area obtained during plastic surgeries without preliminary skin stretching. Results and their discussion. In burn lesions of the skin of the cranial vault, thinning and, in places, damage to the epidermis, pronounced proliferation of connective tissue fibers of the dermis, with atrophy of the sebaceous and sweat glands are noted (Fig. 1, 2).

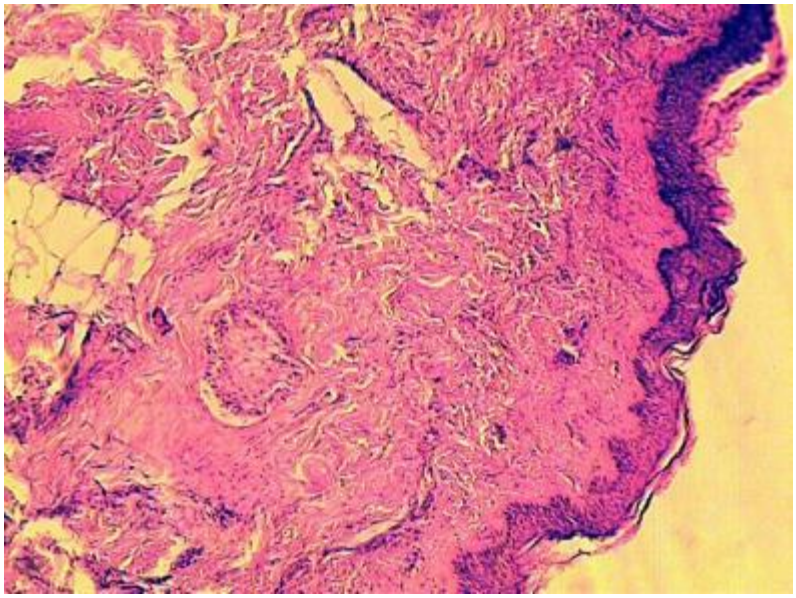

Fig. 1. The skin of the cranial vault, burn, proliferation of connective tissue.

G-E 10x10

Along with thickening and coarsening of the dermal fibers, there are infiltrative accumulations of connective tissue cells, the appearance of cell-free edema zones.

Stretching the skin with balloon dermotension leads to a pronounced unevenness in the thickness of the epidermis, smoothing of the papillary layer of the dermis, it is characteristic that the number of rows of cells in the spinous layer becomes the same throughout. Their number is reduced to 3-4. In the early stages of dermotension, proliferation of connective tissue of the dermis and the preservation of structureless edema zones persist.

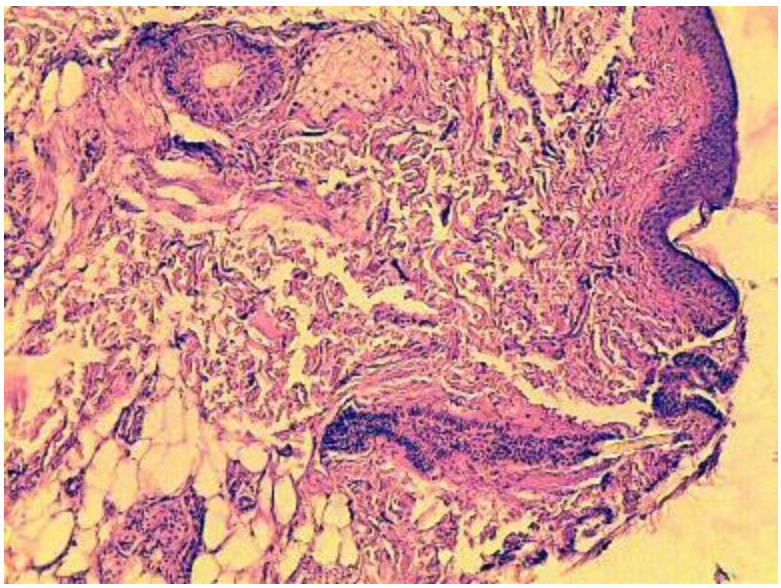

Fig. 2. The skin of the cranial vault, proliferation of connective tissue, damage to the epidermis. G-E 10x10

In more remote periods of intraoperative balloon distension, significant thickening of the hair follicle walls in the dermis is observed, with the appearance of a greater number of hair shafts in them (Fig. 3). This is accompanied by the proliferation of connective tissue layers around the walls of the hair follicles (Fig. 4).

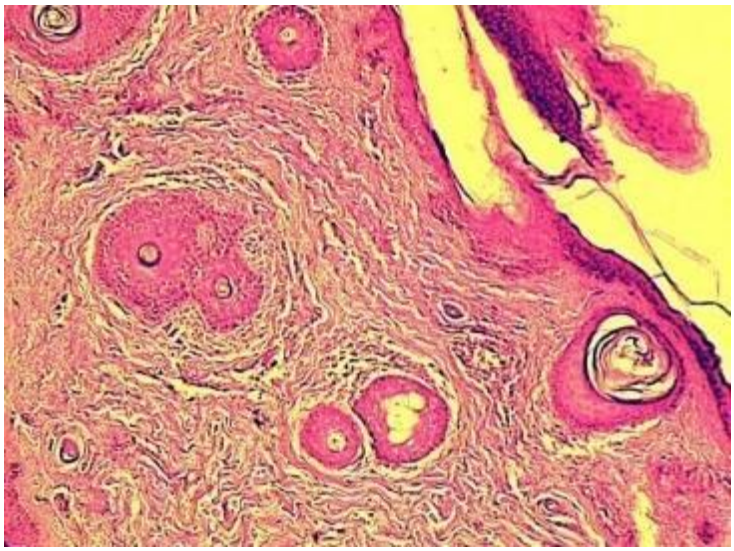

Fig. 3. Hypertrophy of hair follicles. Increase in the number of hair shafts after balloon stretching. G-E 10x40

Fig. 4. Hair follicle hypertrophy after intraoperative balloon stretching. G-E 10x40

In more remote periods of intraoperative balloon dermotension, there is a significant thickening of all layers of the epidermis. This is accompanied by an increase in the volume fraction of microvessels in the dermis and normalization of its structure, which is expressed in the reorganization of the fibrous components, which become thinner, and their location is less chaotic. However, the papillary layer of the dermis remains smoothed.

Intraoperative stretching of the skin leads to the loss of the papillary layer of the dermis, which is not restored even in remote periods of observation.

At the same time, no violation of the integrity of the epidermal part of the skin of the cranial vault is noted (Fig. 5).

No phenomena of acantholysis of the spinous layer were detected. The integrity of the dermis is not violated either. There are no tears in its fibers or violations of the integrity of the vessels. No hemorrhages are detected in the dermis (Fig. 6).

Fig. 5. Hair follicle hypertrophy, increase in the number of hair shafts after intraoperative balloon distension.

G-E 10x40

H- 

Fig. 6. Hair follicle hypertrophy, increase in the number of hair shafts after intraoperative balloon distension.

G-E 10x40

Hemorrhage areas are found only in the hypodermis, among layers of fatty tissue cells. No damage to the integrity of the blood vessel walls was observed (Fig. 7).

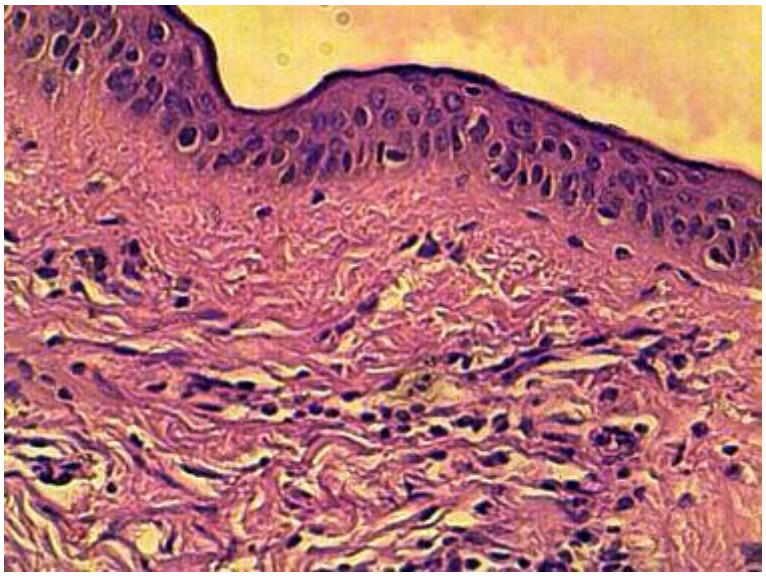

Fig. 7. Restoration of skin structure 30 minutes after intraoperative balloon distension. G-E 10x40

Results. Thus, the morphological studies showed that intraoperative skin distension according to the scheme developed by us in the experiment does not cause violations of its general architectonics. In the epidermis, no violations of integrity in the form of tears or cracks are determined. A decrease in the number of rows of cells in the spinous layer is noted. At the same time, the phenomena of acantholysis and cytolysis are not noted.

In the dermis, skin distension also does not cause structural changes indicating a damaging or traumatic effect of this manipulation. Smoothing of the papillary layer of the dermis is noted. No

damage to blood vessels or hemorrhages in the dermis were found. The reticular-felt structure of the fibrous framework of the dermis is not damaged. The architectonics of the fibrous framework of the dermis is also preserved.

Conclusion. Intraoperative balloon stretching of the scalp using the developed method and scheme does not cause any disturbances to its general architecture, but leads to a significant increase in the number of hair shafts in the hair follicles, which is accompanied by thickening of the walls of the hair follicles.

LIST OF REFERENCES

1. Madazimov M.M., Teshaboev M.G., Influence of various factors on the immediate results of plastic surgery for the consequences of burns of the face and neck//Collection of abstracts of the All-Russian scientific and practical conference "Burns: diagnostics, treatment, rehabilitation", Makhachkala, September 7-9, 2023.

2. Madazimov M.M., Teshaboev M.G., Plastic surgery of cicatricial deformity of the neck with pre-stretched tissues//Collection of abstracts of the All-Russian scientific and practical conference "Burns: diagnostics, treatment, rehabilitation", Makhachkala, September 7-9, 2023.

3. Ubaydullaeva V.U., Fayazov A.D., Ruzimuratov D.A., Kamilov U.R., Morphological assessment of the course of the wound process of burn wounds in burnt patients // Collection of abstracts of the All-Russian scientific and practical conference with international participation "Burns in children and adults", Yekaterinburg, June 6-8, 2024. 4. Khadzhibaev A.M., Tulyaganov D.B., Fayazov A.D., Vervekina T.A., Kamilov U.R., Morphological picture of the wound process when using cellular technologies in the experiment // Collection of abstracts of the All-Russian scientific and practical conference with international participation "Burns in children and adults", Yekaterinburg, June 6-8, 2024. 5.Akhtar MS, Ahmad I, Khan AH, Fahud Khurram M, Haq A. Burn injury in epileptic patients: an experience in a tertiary institute. Ann Burns Fire Disasters. 2014;27(3):126. Accessed April 25, 2022. /pmc/articles/PMC4441316/

6.Heng X, Li H. Timing of Renal Replacement Therapy in Burn Patients With Acute Kidney Injury: A Retrospective Cohort Study. Ann Plast Surg. 2025 May 1;94(5):528-535. doi: 10.1097/SAP.0000000000004178. Epub 2024 Dec 3. PMID: 39652843.

7.Huang, S.-Y.; Huang, J.; Chan, S.; Yang, C. O.; Cheng, C.; Wang, C.; Hsu, C.; Fu, C.; Liao, C. Effect of zinc supplement on patients with trauma: A systematic review and meta-analysis.JPEN J. Parenter. Enteral Nutr.2023, 47, 595–602. [Google Scholar] [CrossRef]