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# New modification of complete corneal stromoplasty

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## Abstract

New technical elements of complete corneal stromoplasty were practiced in an experiment on 25 isolated cadaver eyes; then 7 operations were clinically performed on 7 eyes according to the same procedure. The results have shown that the experimentally tested new technique may be successfully applied in the clinical setting.

**Key words:** *complete corneal stromoplasty, Descemet's membrane, penetrating keratoplasty, detachment.*

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Vestnik oftal'mologii 2010; 126(4):35-37

Anterior deep lamellar keratoplasty with substitution of all corneal layers till Descemet's membrane (DM) has been increasingly used in progressive keratoconus surgery. The main advantages of this method are as follows: the endothelium preservation diminishing the rejection risk of the transplanted cornea; probability reduction of intraoperational complications characteristic of the traditional penetrating keratoplasty (PKP), availability of donor's material based on lower qualitative criteria for the lamellar method. The functional results after the complete corneal stromoplasty (CCS) do not yield to the PKP results, even exceeding them [1–5]

It should be noted that the technique of the corneal CS presents some difficulties: it is not always possible to avoid complications when acquiring DM free from the stroma as a transplant bed bottom [3].

The method suggested by Krasnov, for the first time called complete stromoplasty, consists in grinding off deep stromal layers by use of stomatologic borer [3]. It provides access to the DM 2–3 mm through which the surrounding stromal layer can be mechanically detached from the DM by a spatula. A possible DM perforation during its blunt detachment is related to the complications of the described intervention methods - the "Big bubble" technique - was suggested by M. Anuar [4]. It consists in DM detachment by means of injecting air through the deep stromal layers and allows to remove the stroma safely, attain a smooth interface, to prevent an uneven section of the corneal layers and stromal scarring which are characteristic of the manual dissection [4]. Nevertheless, the method has a number of serious drawbacks. When the air is injected in the deep stromal layers, a corneal pneumatization develops significantly making difficult its visualization. Besides, DM detachment occurs not in all cases because the air chaotically spreads in the stromal layers. When the air falls on the stromal periphery, it can penetrate into the anterior eye chamber

through the trabecular zone and increase the tension in the anterior chamber that increasingly hampers DM detachment.

It should be noted, that in all interventions described, there is possible risk of the DM perforation. If this complication develops, a surgeon has to perform PKP. Thus, the donor transplant, which is chosen for the deep lamellar keratoplasty, must correspond to the same requirements as the transplant for the PKP.

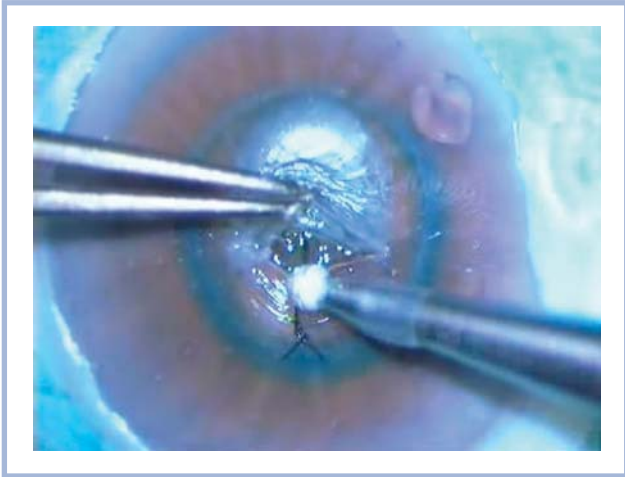
A new method of corneal stromoplasty that does not require the donor material of as high quality as for the PKP, has been introduced by us experimentally and, subsequently, approved in clinic.

The purpose of the present work is an approval and working off the technical elements, patented for a new CS modification, in an experiment, and subsequent evaluation of the intervention in clinic.

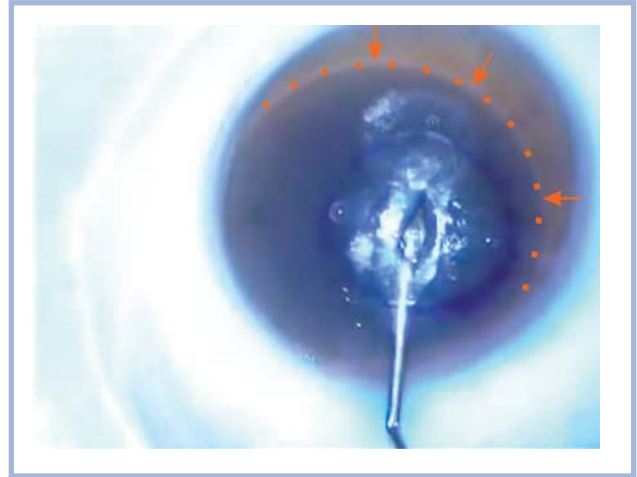
## Material and Methods

New technical elements of the offered intervention were practiced on 25 isolated cadaver eyes in an experiment.

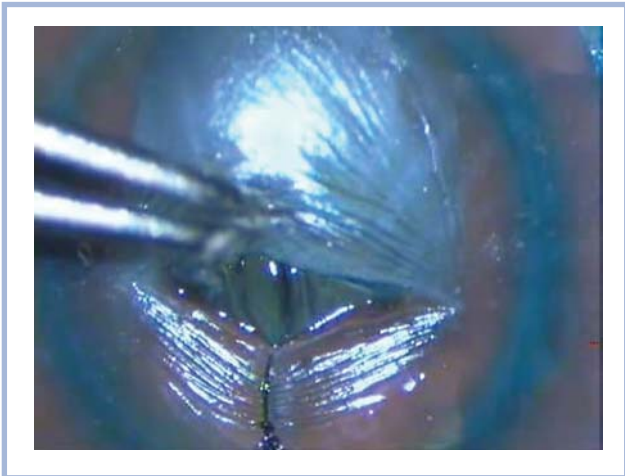
The initial step of the developed operation fulfillment of a linear cut 22 mm in length, the depth of which depending on the corneal thickness. After that, a dissection about 1 mm in width is formed round the cut at the level  $\frac{1}{2}$  of the corneal thickness. Next step is the forming access to the DM on the cut bottom, using a stomatologic borer supplied with the electricity cable with regulated rotation frequency. The borer spherical head, 11 mm in diameter, is covered with fine diamond crumbs (**Fig. 1**). The access is considered to be achieved when a picture typical of descemetocele appears on the cut bottom (**Fig. 2**). An elliptical plate, made of methilmetacrylate, is implanted into the pocket formed in the corneal layers. It serves as a "lid", hermetically closing the cut.



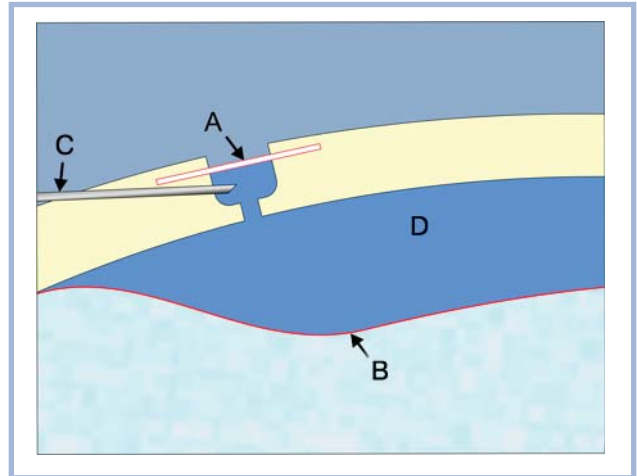
**Fig. 1.** The spherical diamond head of the borer used for the grinding off the deep stromal layers.



**Fig. 3.** The borders of DM detachment visualized due to the stained viscoelastic (showed by the arrows).



**Fig. 2.** The picture characteristic of descemetocelle on the cut bottom.



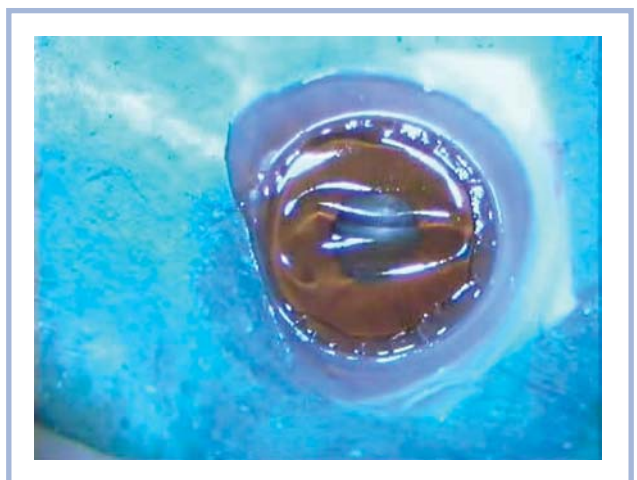
**Fig. 4.** The corneal section.  
A — plate, B — DM, C — cannula, D — viscomaterial.

Then, a stained viscomaterial is forced under the plate in the cut area through a thin needle. DM detachment occurs under the injected material pressure (**Fig. 3, 4**). All stromal thickness, separated from DM, is removed in a traditional fashion after the corneal trepanation till its deep layers. Then, an allotransplant with the previously removed DM, is placed into the shaped bed, being fixed by a blanket suture 10.0 (**Fig. 5**).

With the method described above, 7 operations on 7 eyes with keratoconus of the III—IV stage were performed in clinic.

### Results and discussion

While working off the intervention technique 3 cases of DM perforation (2, 3, 5<sup>th</sup> eye sessions) occurred in the process of grinding off the deep corneal layers. We believe



**Fig. 5.** The shiny folded DM surface — the bottom of the shaped bed (an operation stage in the experiment)



**Fig. 6.** The patient's eye, 31 years old, in 7 months after stromoplasty performed in the IIIb stage keratoconus.

those cases to be due to lack of the technical manipulation skills. In all the rest cases an access to the DM was achieved without its damage. The DM detachment was also obtained in all operated patients.

In biomicroscopy after the operation, the plane borders of the transplant and the bed were indistinguishable (**Fig. 6**). A confocal microscopy revealed somewhat increased reflectivity on the DM border and the stroma as a result of the scarring in this area. The quantity and the quality of endothelial cells after the operation proved to be practically unchanged in the comparison with preoperational ones.

Corrected vision acuity in all operated patients was 0.7—1.0. The degree of the regular corneal astigmatism varied from 0.5 to 3.0D.

More detailed results of the clinical method assessment will be presented by us in a separate report.

## Conclusion

Result of experimental-clinical research showed that the new method of the corneal CS fulfillment, approved in the experiment, can be successfully realized in clinical setting.

At present, we continue our work to improve the operation technique, including creation new instruments, with the aim to facilitate stromoplasty fulfillment and make it more reliable.

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