Lamellar keratoplasties - First results with a new automatic microkeratome

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Summary

Since more than 100 years theoretical and practical reports are published about lamellar dissection techniques. Results after heterologeous transplantation were because of decompensation of the lamellar transplant partially discouraging. First progresses were achieved by using homologeous tissue. Immunological reactions of the eye e.g. decompensation of the transplants are hereby nearly out of question. With modern dissection techniques plano and smooth wound surface can be obtained which is advantageous for optical results. We present the results of our first 12 lamellar keratoplasties performed with the new automatic microkeratome. Results and woundhealing complications are discussed.

Key words: Lamellar keratoplasty - Automatic microkeratome - Corneal lamellar woundhealing

Phillip von WALTER was the first in the early 19th century who recommend the lamellar keratoplasty technique (14). His disciple Franz-Xaver MÜHLBAUER reported 1840 in a prise winning publication about triangle lamellar transplants on rabbit eyes (13). DÜRR performed with rabbit corneas 1877 the first rectangular heterologeous lamellar keratoplasties on human eyes (14). With the invention of the first clockwork-trephine 1877 von HIPPEL improved the important congruity between transplant and woundbed for his heterologeous lamellar keratoplasties (11). However, PAUFIQUE diserves the honour for establishing a simple operation technique for lamellar procedures (15). Because of his good results he propagated 1948 the lamellar dissection techniques for optical and curative indications (15). Lateron HALLERMANN developed a simple device for manual dissection of lamellar lenticles (9, 10). However,BARRAQUER established a microkeratome for lamellar dissection on patient and donor eye which worked with an oscillating blade (2). The optical results after heterologeous transplantation were because of decompensation and clowdiness of the lamellar transplant partially discouraging. By using lyophilized or desiccated heterologeous transplants the results were more successfull and could be improved. This indicates the most important point in corneal lamellar surgery. Immunological reactions of the uveal tract or an immunological decompensation of the transplant are nearly out of question. Especially by us-

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ing homologeous or autologeous tissue for lamellar or lamellar refractive procedures. As opening of the anterior chamber is not necessary intraocular inflammations and other camplications can be avoided. Thereby postoperative treatment is safer and easier. After lamellar dissection techniques a big woundbed regarding the chosen diameter is obtained. In comparison with penetrating keratoplasties the surface for woundhealing is up to four times bigger. Woundhealing in lamellar keratoplasties is different at the edges anterior and posterior surface of the transplants. Fibrocytes of the host and probably of the donor migrate at the edges and produce a circular stabile colagene scar at Bowman's membrane. The epithelium of the donor is rejected and replaced by the host. This epithelial growth is more important for the transplant stability than the adhesion forces in the woundbed. It's healing is prolonged the stroma might be affected. There is nearly no scar formation in the woundbed. Even years after lamellar dissections transplants can be removed easily from the woundbed. However, in the literature and in our own cases we never observed any wound ruptures or traumatic wound dehiscence like after penetrating keratoplasty or radial keratotomy (1, 3, 7, 8, 12, 17, 18).

One of the most important points regarding optical results and quality woundhealing is to achieve an absolutely plano and in particular smooth wound surface. However, these demands cannot be accomplished with manual dissection or microkeratomes with oscillating blades. Therefore we developed a microkeratome with high speed blade rotation which dissects automatically a lamellar under sufficient lubrication within 20 seconds on the patient's eye and even on the donor eye (4, 5, 6,). (Fig. 1).

During two years a lamellar keratoplasty were performed 12 times. The patient age ranged between 13 and 59 with a mean age of 35 years. The indications were 4 patients with keratoconus, 2 patients with recurrent pterygium, 2 patients after superficial chemical burning, 2 patients after herpetic keratitis and bacterial ulceration, 1 patient with epithelial dystrophia.

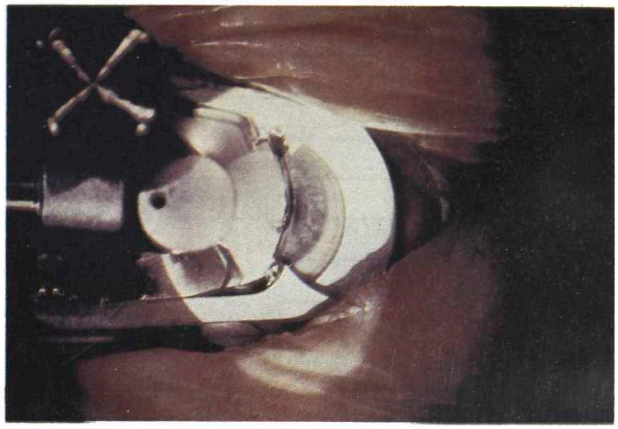

Fig. 1. Automatic microkeratome on patient's eye during dissection.

The lamellar dissection was performed in the same way on patient and donor eye with the automatic microkeratome.

Results

The corneal woundbed showed after each dissection an absolutely plano and smooth surface. The wound edges were circular round and symmetric. Lenticles dissected from donor eyes showed the same morphological features, (Table 1). Due to the corneal thickness of our keratokonus patients we dissected lenticles of 9 mm diameter and a thickness of 2 - 3 mm. We performed 8 - 12 single knots. The post corrected preoperative visual acuity of 0,4 - 0,8 was not reached even 4 months after operation. The single knots were removed after 2 - 3 weeks. The postoperative astigmatism ranged between 0,5 and 3 cylinders. Even 4 months after operation we observed moderate rincles of descemet's membrane which decreased by time and caused moderate blurring sensation, like it is known after epikeratophakia for keratokonus. In patient No. 1 we observed epithelial disturbances decreasing visual acuity. In all

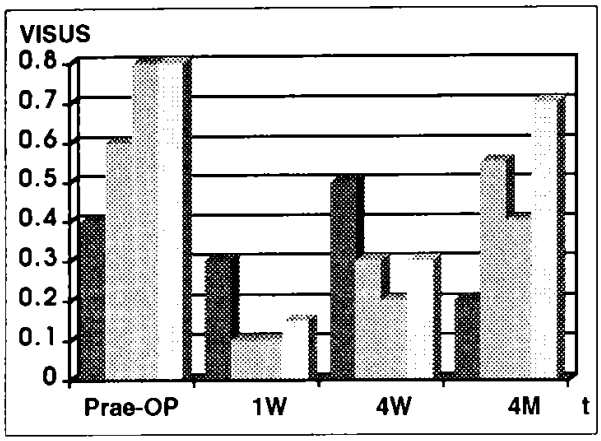

Table 1. Visual acuity of keratokonus patients before and after lamellar keratoplasty after 1 week, 4 weeks, 4 months.

cases the lamellar interface was almost invisible after 4 months. (Table 2).

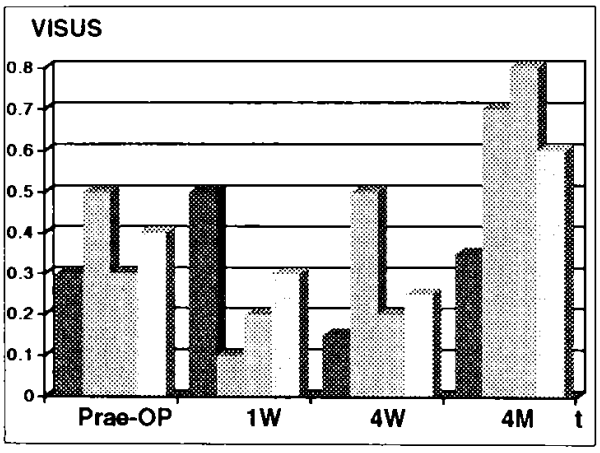

Table 2. Results after lamellar keratoplasty for epithelial dystrophia patient 1, patient 2, 3, 4, lamellar keratoplasty after chemical burning.

Lamellar transplants with a diameter of 9 mm and a thickness of 0,35 mm were performed with running sutures in the above cases. The postoperative visual acuity was much better than the preoperative. After removing the sutures the astigmatism ranged between 1 and 2,5 Dp. of cylinder. An epithelial metaplasia was observed in patient 1 which only slowly decreased under intensive local treatment. The lamellar interface was almost invisible. (Table 3).

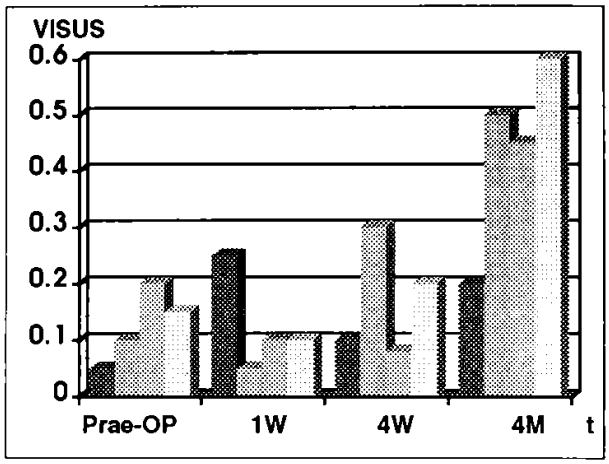

Table 3. Results after lamellar keratoplasty, patient 1 and 2 with recurrent pterygium and affected optical centre, patient 3 and 4 with corneal ulceration and herpetic keratitis.

In the above cases we dissected lenticles of 9 mm diameter and 0,3 mm thickness. The running sutures were removed after 2 weeks. In patient No. 1 we observed a stromal edema of the host cornea and a fluid in the interface mostly in nasal corneal parts but reaching the optical centre and decreasing the visual acuity. Patients 2, 3 and 4 showed a normal woundhealing and an enormous increase of visual acuity 4 months later.

This patient (fig. 2) with keratokonus showed 4 months after lamellar keratoplasty a clear cornea, the wound edges are smooth and almost invisible. The best corrected visual acuity was 0,7 and the patient complaint a little bit about blurring due to really moderate rincles at Descemet's membrane. The above picture (fig.3) showed a 65 year old lady 3 weeks after lamellar keratoplasty for treatment of recurrent pterygium with affected optical centre. A stroma edema and some deposits in the interface are visible. This might be a sign for low endothelial function and low corneal metabolism that in this case probably a penetrating keratoplasty could have been better.

Fig. 2. Lamellar keratoplasty of keratoconus 4 months after operation.

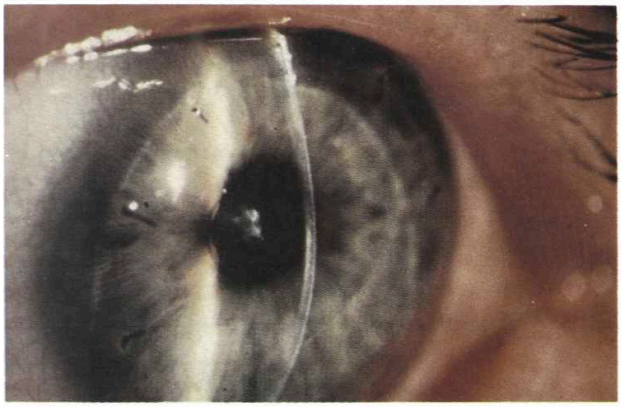

Fig. 3. Lamellar keratoplasty of recurrent pterygium 3 weeks after operation.

Discussion

One aim in lamellar keratoplasty is to dissect a regular and smooth surface. If a surface is not regular or if blood vessels and stromal opacities remain after dissection lipoids, calcium crystalls and hyaline degenerations could be sedimentated in the interface. These deposits might grow and impact considerably the optical result. An intact corneal metabolism and an excellent woundbed and operation technique might be helpful to avoid these complications.

Because of the mechanical flattening of keratokonus eyes during suturing the corneal tissue is compressed, which leads to rinckles at Descemet's membrane. However these rinckles disappear by time and the visual acuity increase.

The automatic rotor microkeratome is a simple and precise surgical instrument. It is possible to dissect plano and round lenticles with smooth surface on the patient eye and even on the donor eye. By using this microkeratome for anterior stromal scars, opacification, vascularisation or surface irregularities lamellar keratoplasties might be less complicated faster and safer than penetrating keratoplasties.

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