INTRA-CORNEAL LAMELLAR KERATOPLASTY*

BY

TADEUSZ KRWAWICZ

Ophthalmological Clinic, Medical Academy, Lublin, Poland

THE operative technique of lamellar keratoplasty is still a problem. Various methods and appliances, such as direct and overlying sutures and protective shields, have been developed to ensure a good coaptation between the graft and the host bed, and to minimize the additional trauma which such devices usually give to the corneal tissue. These all have, however, the basic inconvenience of complicating the procedure which in itself is delicate enough. The result is that this valuable therapeutic method has not yet become as popular among eye surgeons as it ought to be.

A new method of fixing the graft has been developed in experiments on animals (Krwawicz, 1960), and the present paper reports the first clinical results so obtained.

Lamellar keratoplasty has so far been carried out only on the surface of the cornea, the transplant being fixed to the host bed by sutures. By the new procedure the graft is introduced into a pocket, the walls of which are formed by the scar tissue in front, and by the deeper layers of the corneal stroma behind. The scar, which forms the anterior wall of the pocket, gives temporary protection to the graft and is removed when the union between the graft and the host cornea has been established. No sutures are needed to fix the graft, as its position inside the corneal pocket is perfectly stable.

The positive results obtained by this method experimentally, evidenced by the absence of complications in healing and by the preservation of the transparency of the graft convinced us that it was possible to eliminate failures due to the dislodgement of the graft, and encouraged us to test the clinical value of our method.

Operative Technique

Under local anaesthesia, lid sutures are placed and the eyeball is immobilized with sutures placed in the superior and inferior recti. Then a vertical incision, about 4 mm. long, is made with a keratome. The incision lies near the limbus and penetrates into the

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deep layers of the corneal stroma, sometimes very close to Descemet's membrane (Fig. 1). From this incision the cornea is split longitudinally towards the centre, first with a cystotome (Arkin, 1956), and then with a small flat knife, so that a channel 4 to 5 mm. wide is formed. In the central part of the cornea the scar tissue is undermined through a slightly broader area (Fig. 2).

FIG. 1.—An incision about 4 mm. long is made with a keratome at the corneal limbus.

FIG. 2.—Final stage of splitting. A pocket is formed in the central part of the cornea under the scar.

A pocket is thus formed, into which the lamellar graft is introduced with a spatula. The insertion can be made easier by lifting the edge of the incision with a thin spatula. Wrinkled grafts can be made smooth by introducing a spatula into the pocket, and this will also help the graft to retain its position, thanks to the suction exerted by the closely adhering walls of the pocket (Figs 3 and 4).

FIG. 3.—Graft introduced under scar.

FIG. 4.—Graft in place.

Atropine and antibiotics are introduced into the conjunctival sac. A uniocular dressing is applied and the patient is allowed to move freely, there being no danger of the dislodgement of the graft. The dressing is removed on the following day.

On the 6th to the 8th day after the transplantation, when the graft is firmly attached to the bed, the anterior wall of the pocket, *i.e.* the scar proper, is removed. This is done

with a trephine, the diameter of which is slightly smaller (1 mm. less) than that of the transplant. A narrow ring of the host cornea is thus left round the edge of the graft, and additional support is afforded to the transplant (Figs 5 and 6).

FIG. 5.—Scar removed with a 4-mm. trephine on the eighth day after transplantation.

FIG. 6.—Transplant exposed after removal of excised scar.

A few days after the excision of the scar, topical administration of cortisone is started.

The donor graft can be prepared by any of the current methods, although in our opinion the best results are obtained by the use of the following modification, which is based on the same principle as the operation described above. The donor cornea is incised with a keratome near the limbus. From the incision line a suitable thickness of the corneal tissue is undermined through a broad area and then its central part is excised with a 5 mm. trephine, the anterior chamber remaining untouched (Figs 7 and 8).

FIG. 7.—Donor cornea is split from the incision at the limbus towards the opposite margin.

FIG. 8.—Lamellar graft excised from donor cornea with a trephine.

Results

The intra-corneal lamellar keratoplasty described above has been performed in six cases of corneal opacity affecting the superficial and deeper layers of the corneal stroma. In all these cases the first part of the operation, *i.e.* the

transplantation proper, proceeded without complications. In one patient (Case 5), the removal of the scar was complicated by the detachment of the upper part of the graft from its bed. This faulty union was due to the fact that the graft was prevented from lying flat in its bed by the inadequate size of the pocket. After the excision of the scar the graft reattached itself, still preserving its clarity. In the other five cases the union between the graft and the bed was good and withstood well the excision of the scar tissue.

TABLE
RESULTS IN SIX CASES

Case No.	Sex	Age (yrs)	Eye	Diagnosis	Corneal Opacity	Vessels	Pre-operative Visual Acuity	Graft Clarity	Post-operative Visual Acuity	Accompanying Ocular Changes
1	F	50	Right	Scarring following inflammation	Dense central Moderate in rest of cornea	Few, fine	0·5/60	Clear	2/60 after 3 mths	Incipient cataract
2	F	57	Right	Scarring following inflammation	Fairly dense Anterior strata	Few, superficial	0·5/60	Clear	1·5/60 after 2 mths	Posterior synechiae and incipient cataract
3	M	23	Right	Scarring following trauma	Extending deep into stroma	Few, fine	0·5/60	Clear	2/60 after 2 mths	Eye amblyopic
4	M	50	Right	Scarring following inflammation	Anterior layers of stroma opaque	Old, atrophied	1/60	Fairly clear	2/60 after 1·5 mths	Poor vision due to myopic choroiditis
5	F	50	Right	Scarring following inflammation	Dense central and peripheral	Deep, fine	0·5/60	Clear	6/60 after 1·5 mths	Posterior synechiae and incipient cataract
6	F	61	Right	Scarring following inflammation	Middle layers	Small towards scar	2/60	Partially opaque	2/60 after 1 mth	—

In all cases the healing process was free from any symptom of infiltration or necrosis of the graft. Immediately after the removal of the anterior wall of the pocket a slight transient haziness of the epithelium of the transplant could be occasionally observed, and sometimes there was some peeling of the transplant epithelium.

In five cases the post-operative course was uneventful, the transplant preserved its clarity, and the vision was improved. In one patient (Case 3), in whom the scar extended into deeper layers of the corneal stroma, an opacity was visible under the clear transplant. There was, however, some visual gain. In one patient (Case 6), the graft was partially opaque and the vision remained unimproved. The Table shows that in some patients the comparatively

small visual gain must be ascribed to co-existing pathological changes in the ocular media and in the fundus. Figs 9 and 10 show the pre-operative state and the final result of the operation in one patient (Case 1).

FIG. 9.—Case 1, pre-operative state.

FIG. 10.—Case 1, final result.

There is no evidence that the 6 to 8 days' stay inside the corneal pocket has a negative influence on the clarity of the graft.

The final results of our two-stage method of intra-corneal lamellar keratoplasty seem to justify its introduction into clinical practice, especially in cases of more superficially situated opacities, or for ameliorative or therapeutic purposes (diseases of the graft). The new method eliminates completely the risk of failure due to faulty apposition of the graft following the bulging of Descemet's membrane; it minimizes or eliminates the danger of the dislodging of the transplant, simplifies the operative technique by avoiding suturing, and decreases the operative trauma. It is our hope that all these advantages will make it possible to perform lamellar keratoplasty on a larger scale and with greater assurance than has been possible so far.

REFERENCES

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