

RECTANGULAR AUTOGENOUS LAMELLAR KERATOPLASTY*

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MANY of the stationary corneal opacities causing diminution of vision are central, avascular, and superficial, and are surrounded by clear cornea or have a neighbouring peripheral clear corneal area of 4×4.5 mm. Donor homogenous corneal grafts are not always available, but a rectangular lamellar autogenous corneal graft can be dissected and turned 180° so that the clear lamellae are brought in front of the pupil and the opaque lamellae lie peripherally.

Morax (1913) utilized a hand trephine with which two equal circles were marked out in the same cornea, one in the leucoma opposite the pupil and the other in a transparent peripheral area. The leucomatous lamellae were cut as deeply as necessary but the transplant zone was entered only slightly and this disc was applied on the area of the removed leucoma. The opaque disc might or might not be applied. No sutures were placed, the transplant adhering well with only bandaging and rest. In case of central leucoma, Gradle (1921) trephined an area 6 mm. in diameter, half embracing the leucoma and half a transplant collateral area. After lamellar dissection of the corneal disc, it was rotated 180° so that the transparent area occupied the pupillary field.

Surgical Technique

The following description is that of a case of central superficial corneal opacity with a clear corneal area above measuring 4×4.5 mm.

Surface pantocaine, retrobulbar novocaine, and O'Brien's akinesia are used. Superior rectus and lower lid traction sutures open the palpebral aperture. The pupil is kept at the normal size without dilatation. A Castroviejo double-bladed knife is adjusted so that the distance between the two blades is 4.5 mm. The twin-knife cuts vertically upwards into the outer two-thirds of the corneal lamellae, each blade cutting 2.25 mm. on either side of the centre of the pupil, from just below the level of the pupillary margin to the upper limbus. The scarred corneal area in front of the pupil and the clear corneal area above it are thus included between the two incisions. If the pupil is about 4 mm. in size, cutting from 0.5 mm. below it leaves 2.5 mm. uncut. Each of the long limbs of the graft is about 8 mm. in length. The upper ends of the incisions are connected by a horizontal incision with a von Graefe knife cutting the outer two-thirds of the corneal lamellae.

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A horizontal corneal incision connects also the lower ends of the two long vertical incisions. The corneal incisions are marked out by fluorescein. The corneal incisions pass through the superficial opaque corneal lamellae and reach a plane of deep corneal lamellar cleavage where it is easily possible to evert the graft edges by a corneal forceps. If this is not achieved the corneal incisions are carefully deepened—so as not to perforate the cornea—with the von Graefe knife until a plane of cleavage is reached. This is especially important in the upper incision from which the corneal splitting is going to proceed. Using fine corneal needles and virgin silk a traction suture is inserted in each of the two upper corners of the graft. The upper edge of the graft being thus raised, a pyriform Barraquer corneal knife splits the corneal lamellae along the corneal cleavage plane, separating the graft without corneal perforation. The lower horizontal border of the graft is cut by a spring scissors. The rectangular lamellar corneal graft obtained is turned 180° and placed in its bed so that the clear upper corneal lamellae are brought in front of the pupil, taking care that the epithelial surface remains outwards. Six border-to-border sutures are placed to fix the graft to its bed edges. Each traction suture is used to fix the graft at the lower inner and outer corners. Two sutures are applied at the upper corners and one to the middle of each long side of the graft (Fig. 1). If abnormal vessels are cut during graft dissection, beta-rays 500 roentgen units are applied at the end of the operation and once every week for another two sittings to prevent vascularization of the graft. Both eyes are bandaged. Dressing is done every 2 days. The bandage is removed from the unoperated eye after 6 days, and the sutures on the eighth day. Fig. 2 shows the clear graft in front of the pupil 10 days after the operation. Dressing with cortisone and vitamin A eye ointments is continued daily for one month.

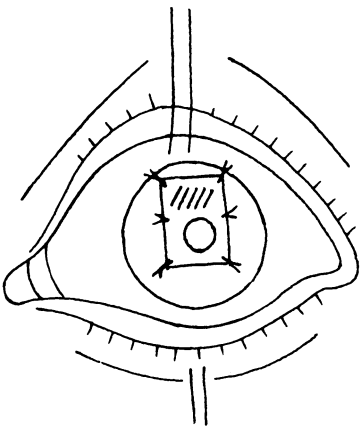


FIG. 1.—Diagram showing graft turned 180° so that the clear upper corneal lamellae are in front of the pupil. Note the six border-to-border sutures.

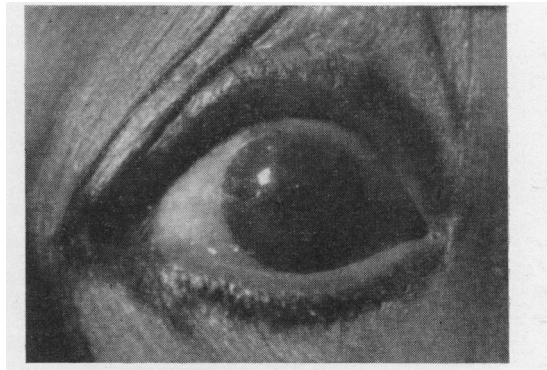


FIG. 2.—Successful result 10 days after operation, showing clear cornea in front of pupil.

The same technique may be used in cases of superficial corneal opacities including the central area so long as there is a peripheral 4×4.5 mm. clear corneal area in any direction. The long borders of the graft are directed so as to include the transparent corneal transplant and the central opaque area.

Case Reports

Twenty cases of central nebulae have been operated upon by this technique. Typical results in seven cases are shown in the Table. Slit-lamp examination showed that there was nothing abnormal in the anterior part of the eye besides a corneal nebula occupying one or two-thirds of the anterior corneal lamellae. These corneal opacities were the result of corneal ulcers occurring with acute conjunctivitis. Conjunctival smears taken before the operation were negative for organisms. The fundi and ocular tension were normal. The corrected visual acuity was estimated before and every month after the operation.

TABLE
RESULTS IN SEVEN CASES

| Age (yrs) | Sex | Duration of Opacity (yrs) | Corrected Vision before Operation | Improvement with Dilatation of Pupil | Clarity of Graft in front of Pupil | Corrected Vision 1 yr after Operation |
|-----------|-----|---------------------------|-----------------------------------|--------------------------------------|------------------------------------|---------------------------------------|
| 25 | M | 2 | 3/60 | 5/60 | Clear | 6/60 |
| 28 | F | 1 | 2/60 | 5/60 | Clear | 6/24 |
| 30 | M | 20 | 2/60 | nil | Clear | 2/60 |
| 32 | F | 30 | 1/60 | nil | Clear | 2/60 |
| 40 | M | 20 | 3/60 | nil | Clear | 3/60 |
| 43 | M | 3 | 4/60 | 5/60 | Clear | 6/36 |
| 46 | M | 3 | 2/60 | 4/60 | Clear | 6/24 |

The general condition of all the patients was good. There were no septic foci in the bodies, the blood Wassermann reaction was negative, and the urine was free of albumen and sugar.

Vitamin A, B-complex, and C, and local Terramycin, and vitamin A eye ointment were used for 7 days before and one month after the operation.

All the grafts remained clear, and the visual results were good in non-amblyopic eyes. There were no post-operative complications, such as infection, glaucoma, dislodgment, vascularization, or cloudiness of the graft.

Discussion

In the living eye the average minimal corneal thickness at the centre is about 0.5 mm., increasing to 0.74 mm. at an angular distance of 40° from the centre (Duke-Elder and Wybar, 1961). von Bahr (1948) measured the thickness of the central cornea in 125 healthy persons of both sexes, and his findings averaged 0.565 mm. According to Kokott (1934; 1935; 1938), there is a general tendency for the bundles of the corneal substantia propria in the superficial layers to run upwards and downwards vertically, for those in the middle layers to direct themselves towards the insertion of the recti, and for the deeper layers in the periphery to show a tendency to a circular arrangement.

Ehlers (1929) demonstrated structural difference between the anterior lamellae and those in the posterior two-thirds of the stroma. The superficial fibre bundles criss cross each other at definite angles, each change of direction involving a change of level. In the deeper stroma, the bundles tend to follow definite planes, which gives this tissue a more truly lamellar structure.

In the superficial corneal stroma there is no such plane of cleavage as in the deeper lamellae. The main secret of success with the rectangular autogenous lamellar graft lies in making corneal incisions which delimit the graft not perforating, but through two-thirds of the thickness, so as to reach a lamellar cleavage level. This can be seen when the edges of the graft can be easily everted by a corneal forceps. Once the cleavage level is reached, it is easy to separate the graft with the pyriform Barraquer knife or Desmarres' scarifier. If this method is followed corneal perforation never occurs.

As the average vertical corneal diameter is 10.6 mm., to obtain a centrally-placed *round* lamellar graft in front of the pupil taken from the clear periphery of the same cornea, the graft can never be more than 3 mm. in diameter so as to leave 1 mm. between the recipient bed and the donor area. A graft of 3 mm. diameter is too small, especially when border-to-border sutures are to be used; also this operation entails the removal, interchanging, and suturing of two corneal discs.

If the central opacity is 4 mm. in diameter, after an eccentric 6 to 7 mm. round graft is rotated through 180° the edge of the transplant may traverse the pupil. But this rectangular autogenous lamellar graft will cover the pupillary zone with a clear corneal transplant measuring 4.5 × 4 mm.

The clouding of the graft through tissue incompatibility or allergic reaction, which sometimes occurs with homogenous grafts, is not seen in autogenous grafts. As the rectangular autogenous-lamellar corneal graft is turned 180°, it is better to bring the nebula to the upper part of the cornea where it is hidden by the upper lid.

The lamellar graft supports the thin keratectomy bed preventing the corneal ectasia, perforation due to slight trauma, and recurrence of the opacity which often occurs with simple keratectomy. The visual results are better than those obtained by partial lamellar keratectomy or iridectomy.

After 6 to 12 months the nebula in the upper part of the cornea, the graft union edges, and any fine deep opacity extension left in front of the pupil tend to disappear. Paufique (1955) wrote that "It is interesting to note that often in these cases the well-known trophic influence of keratoplasty can exert itself not only in the periphery of the cornea but also in the depth, and one has observed in the following months a progressive clearing of the remaining opacities with consequent improvement of the functional result".

Summary

In cases of superficial stationary central corneal opacities with a neighbouring peripheral area of clear cornea measuring 4 × 4.5 mm., a rectangular lamellar autogenous corneal graft is dissected and turned through 180° so that the clear area comes in front of the pupil. This method gives better visual results than partial lamellar keratectomy or iridectomy. Homogeneous corneal

grafts may not be available or should be reserved for cases with deep central opacities requiring a penetrating keratoplasty.

All the twenty cases done by this method were successful.

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