CASE NOTES

THREE UNUSUAL CORNEAL GRAFTS*

BY

B. W. RYCROFT

*From the Corneo-Plastic Unit and Regional Eye Bank,
Queen Victoria Hospital, East Grinstead, Sussex*

At a recent hospital demonstration of corneal graft cases three examples, which are described below, evoked special interest.

Case 1, Contralateral Corneal Autoplasty.—There are two types of case in which the patient supplies his own donor corneal graft, *i.e.* an autograft. One type may be termed ipsilateral autoplasty when the graft is provided by the cornea which itself is to be grafted, and the other, contralateral autoplasty, when the graft comes from the other cornea of the same patient.

Ipsilateral autoplasty is performed when a disc of cornea having a clear area is fashioned so that it can be rotated to replace an opaque area over the pupil (Kraupa, 1914). Another method is to exchange a disc of scar tissue over the pupil with a clear graft from the periphery of the same cornea (Morax, 1913).

Contralateral autoplasty is performed when the graft is obtained from the cornea of the patient's other eye. Plange (1908) has reported such an example, using a lamellar graft.

Whilst it is often vouchsafed to plastic surgeons to use skin autografts in their treatment of burns, opportunities for ophthalmic surgeons to use corneal autografts are very rare.

Clinical Report

An unemployed dock labourer aged 50 years was referred to the Corneo-Plastic Unit at East Grinstead on May 11, 1954, by Mr. S. S. Sumner of Preston.

Up to 1944 the vision had been normal in each eye, but suddenly the vision of the left eye was lost after a period of "soreness"; no active treatment was sought at the time. In 1952 the right eye became ulcerated, resulting in a scar and almost total blindness. Mr. Sumner diagnosed disciform keratitis and, when the eye was quiet, a lamellar graft was performed which gave some improvement.

The previous history revealed nothing of ophthalmic significance. The patient had been generally fit, well, and free from illness. He had received a blow on the top of the head with a hammer in 1946 and scalp stitches were inserted; there had been no effect on vision.

The family history revealed nothing of ophthalmic significance.

Examination (9.7.54).—The patient fixes with the right eye and the left eye is 5° divergent.

Visual acuity in the right eye is "gross hand movements" with brisk and accurate projection to a dull light; unable to distinguish fingers at 1 metre. Normal tension on palpation.

* Received for publication March 4, 1957.

A dense white scar involved almost the entire corneal area; in the centre of the scar was a 7-mm. circular lamellar graft through which could be seen scar tissue in the posterior half of the corneal thickness (Fig. 1).

FIG. 1.—Before operation. The lamellar graft and leucoma are seen on the right cornea. The left cornea is normal.

The thickness of the cornea was increased by 50 per cent. and there was deep and active vascularization throughout the scar tissue. The limbal area was clear and iris details could be seen; pupillary reactions were normal. On full mydriasis there were posterior synechiae at 12 and 1 o'clock; the lens was clear. A good red reflex was present but no fundus details could be seen.

The left eye was 5° divergent with full movements. Normal tension on palpation. No perception of light. The cornea was normal with no cells on the post-corneal surface and no scar. The anterior chamber deepened to the pupil which had a total ring synechia. There was a secondary cataract; no red reflex was discernible.

Plan of Operation.—Contralateral corneal transplantation, using the left cornea as donor to the right eye.

Operation (3.8.54).—Anaesthesia comprised surface instillation of 4 per cent. cocaine drops with a regional orbital block of 1 per cent. lignocaine. Facial akinesia was obtained by the O'Connor method and the area of the superior rectus muscle was also infiltrated.

Corneal overlay sutures were prepared on both sides; a 6-mm. full thickness donor graft was cut from the normal left cornea and with the same trephine a similar disc was cut from the scar tissue of the right cornea; after transposition the grafts were held in place by three overlay sutures. On the right side there was good apposition and contour with speedy reconstitution of the anterior chamber, but on the left side egg membrane had to be used as there was some difficulty in fitting a piece of scar tissue into a normal cornea. 1 per cent. chloramphenicol ointment was inserted, both lower lids were drawn up, and double pads applied.

First Dressing (9.8.54).—There was no lid oedema and the lid sutures were in good position; they were removed. The cruciate overlay sutures were in place on both sides and there was no disturbance of the egg membrane on the left side. All were removed; both anterior chambers were normal. No unusual vascularization or reaction; no anterior iris adhesions (Fig. 2).

FIG. 2.—After operation, showing transposition of grafts.

Discharge (28.8.54).—In the right eye the graft is clearing steadily and there is good fibrous ring formation. Visual acuity 6/36. No anterior synechiae. Tension normal.

In the left eye the scar disc in the cornea shows slight superficial vascularization. Tension normal.

Result.—As was to be expected there were few biological changes in this autoplast graft and convalescence was uneventful.

On 7.2.57 the visual acuity in the right eye was 6/9 (unaided), and there had been no discomfort in the last 2½ years (Fig. 3*a, b*).

The graft in the right eye (3*a*) is still quite clear without vascularization and there are no complications. In the left eye (3*b*) the disc of scar tissue has healed well; it will be interesting to observe changes in this graft during the next few years.

FIG. 3 (*a* and *b*).—2½ years after operation; visual acuity in the right eye = 6/9.

Case 2, Use of Donor Graft preserved at -79° C. for Full-Thickness Keratoplasty.

—For some years it has been obvious that a long-term method of storing corneal donor material would be desirable when supplies improved. As a result of the Corneal Grafting Act, 1952, the supplies of donor eyes have increased at East Grinstead from 37 eyes in 1951 to 212 eyes in 1956. The method of Bürki (1947) of storage in oil at 4° C. is safely valuable up to 14 days, but, although clear optical grafts have been obtained after 23 days' storage by this method (Rycroft, 1955), such a long period of storage is not to be recommended. Unfortunately, the oil medium has the disadvantage that antibiotics in it cannot be brought into intimate contact with the donor material and also that the oil tends to cling to the corneal material at operation.

Following the promising work of Polge, Parkes, and Smith (1949) on the preservation of spermatozoa at low temperatures, it was decided three years ago with the co-operation of R. E. Billingham of University College, to try to bank eyes and corneae at -79° C. after previous treatment with antibiotics and 15 per cent. glycerol.

First the cadaver eyes or corneae were carefully examined and cultured; next, they were soaked for 20 minutes in an antibiotic solution of penicillin and streptomycin; they were then immersed for one hour in 15 per cent. glycerol. Thereafter, the material was slowly frozen to -79° C. and was maintained at that temperature indefinitely by dry CO_2 snow. When required the eyes were thawed rapidly to $+37^{\circ}$ C. and used immediately. With various modifications, and using the new medium described by Sachs (1957) instead of oil, this procedure is now in constant use at East Grinstead.

The following case was treated over 3 years ago with a corneal graft preserved in this fashion: vision has been maintained.

Clinical Report

A grinder of silica fire bricks, aged 51, complained of bad sight in both eyes, the right eye being the worse.

After diphtheria at age 2 he had had severe eye ulceration and blindness. Two operations were performed by Treacher Collins (optical iridectomies).

The patient had cement dermatitis but no other general illness.

The family history revealed nothing of ophthalmic significance.

Examination (11.11.53).—Both eyes fixed and there was no deviation.

In the right eye there was a dense white central leucoma with clear peripheral corneal tissue (Fig. 4). The anterior chamber and iris details could be seen through the periphery; there was an optical iridectomy above. The leucoma involved all thicknesses of the cornea which was increased in thickness by +25 per cent. There was no active vascularization but early appearances of band-shaped keratopathy were seen. On mydriasis the lens was clear: there was a bright red reflex but fundus details were not seen. The visual acuity was counting fingers at 1 metre. Projection was accurate and brisk to a dull light. Tension on palpation was normal.

FIG. 4.—Before operation (November 11, 1953).

In the left eye the leucoma was grey and not as dense as on the right side (Fig. 4). The cornea was of normal thickness without active vascularization. Iris details could be seen; there was a vertical optical iridectomy. On mydriasis the lens was clear and fundus details were just discernible. The visual acuity was counting fingers, but rather better than on the right side. Tension was normal on palpation. Binocular vision was just 1/60 and there was no improvement on contact lens trial.

Plan of Operation.—Full-thickness keratoplasty in the right eye.

Operation (17.11.53).—Anaesthesia included general basal sedation and local 4 per cent. cocaine drops; regional orbital block with 1 per cent. lignocaine and 5 per cent alcohol. O'Connor facial block was used with superior rectus infiltration with 1 per cent. lignocaine. Alcohol was included in the orbital and facial blocks as the patient was particularly sensitive and apprehensive.

A 5.1-mm. full-thickness keratoplasty was performed on the right eye. Fixation technique was by three overlay mattress sutures and egg membrane cover. There were no incidents or operative complications. The donor graft came from a cadaver eye excised 4 hours *post mortem* and preserved at -79°C . for 4 weeks. On inspection the donor cornea was clear and bright with no wrinkles or air bubbles after thawing.

First Dressing (24.11.53).—The graft had a good contour; there was wrinkling of

Descemet's membrane. The anterior chamber had reformed and iris details could just be seen through the graft. There were no iris adhesions and no undue reactions. The sutures were removed and a uniocular pressure dressing applied.

Three days later there was considerable general psychiatric disturbance, but no damage was done to the eye.

Discharge (8.1.54).—There were many patches of eczema on the face, neck, and hands, which was considered to be associated with the nervous condition, the patient having had similar skin reactions before. The right eye was white and quiet but the graft was now hazy. The contour was good and the fibrous ring was well healed (Fig. 5) with a small shelf in the infero-nasal quadrant. There was no vascularization and no epithelial bullae were present; the ocular tension was normal.

FIG. 5.—7 weeks after operation. There is no vascularization but the graft is completely cloudy. A fresh graft at this period would have been clear.

Result.—The graft and adjacent tissue continued to clear slowly; there was no active superficial or deep vascularization, the visual acuity was 6/36 (Fig. 6, 25.4.55).

FIG. 6.—17 months after operation (April 25, 1955). The graft is clearer and the optical iridectomy is seen. There is even contour with a good fibrous ring.

Approximately 2 years after the operation (28.10.55), the graft was 100 per cent. clear and iris details were well seen (Fig. 7*a* and *b*, opposite). Placido keratometry showed even and regular circles. Visual acuity without correction was 6/24 to 6/18 (1 letter). Fundus details were well seen and were normal.

FIG. 7 (a and b).—Nearly 2 years after operation (October 28, 1955). The graft is clear and the visual acuity is 6/12 (unaided).

The eye was quiet with normal tension $3\frac{1}{2}$ months later. The visual acuity was 6/12 (unaided) and N.10.

Comment.—This case shows the use of a donor graft preserved for a month at $-79^{\circ}\text{C}.$, and establishes *prima facie* evidence that long-term storage at low temperature is possible. It is noted that the graft behaved in a different manner from a graft used after short-term preservation at $+4^{\circ}\text{C}.$; there was a long latent period before function was restored. This delay in the recovery of function has also been noted in ovary transplantations when the material has been preserved by this method. More recent corneal graft cases, however, with modification of deep freeze technique, have given very encouraging results, and it is felt that this method will become the bank method of preservation for the future.

Case 3, Severe Corneal Damage and Multiple Perforations treated by Lamellar Keratoplasty with Recovery of Useful Vision.—This illustrates the progress of a man who was quite blind, and whose case would have been considered hopeless a few years ago; after several operations there was restoration of corrected vision to 6/12. It also emphasizes how a very small area of clear cornea can be of immense value to a patient if he has the courage to face many operations and the will to persevere in rehabilitation.

Clinical Report

A research fellow in chemistry, aged 26, was studying in Paris, when on May 15, 1950, whilst he was purifying an ethyl compound, a glass retort exploded. He was treated for multiple eye perforations in Paris and subsequently returned to England, where Mr. Roy Thomas referred him to East Grinstead (Fig. 8, opposite).

FIG. 8.—Before operation.

Examination (9.10.50).—The right cornea showed many circular grey opacities; some were discrete and some were confluent. These opacities marked the sites of multiple perforations of the cornea by spicules of glass; they involved total corneal thickness. Many fine glass particles were also embedded in the stroma of the cornea and iris. Through the edge of the nasal cornea many anterior synechiae were visible and there were lens capsule remnants; a dim red reflex with no details could just be detected. The visual acuity was “perception of gross hand movements but inability to see fingers”; there was brisk and accurate projection to a dull light in all quadrants. The ocular tension was normal on palpation.

The left eye showed a similar condition with more confluence of the opacities and few anterior chamber details could be seen. Vision was “perception of light with no accurate projection”, and the ocular tension was subnormal on palpation.

There was nothing of significance in the past ophthalmic, general, or social history; spectacles had not been worn and vision had been normal and equal in each eye. There had been no previous eye operations (Fig. 9).

FIG. 9.—Right eye, showing multiple healed corneal perforations.

Plan of Operation.—As the right eye was aphakic, it was considered that a full-thickness graft was not justified, especially as this was the only eye with potential sight. It was decided that attempts should first be made to clear the anterior synechiae and then to carry out a deep lamellar keratoplasty. The left eye was beyond treatment.

Operations (7.11.50).—Anterior synechiotomy (3 synechiae) followed by subconjunctival mydrine.

Two weeks later the patient suffered from otitis media with perforation of the right ear drum as a result of the previous explosion; he had 30 per cent. loss of hearing.

(12.12.50).—Second anterior synechiotomy (2 synechiae divided). The central area of the cornea was now free from iris adhesions.

(9.2.51).—Lamellar keratoplasty. A 7.1-mm. graft bed was prepared, going as deeply

as possible; several glass spicules were encountered on the way. A lamellar graft of the same size, which had been taken 15 hours after death and stored for 2 days, was inserted. Fixation was by egg membrane and overlay silk sutures. Through the graft bed it was possible to see anterior chamber details in the upper and inner quadrant, and gross peripheral anterior synechiae were seen underneath dense scar tissue on the temporal side. Convalescence was uneventful but there was considerable superficial trunk vascularization.

(9.4.51).—Strip peritomy with cauterization and dissection—excision of trunk vessels.

Discharge (22.4.51).—The visual acuity was described as “able to count fingers and to get about; a guide stick is no longer necessary” (Fig. 10).

FIG. 10.—Right eye after lamellar keratoplasty, showing small clear areas of cornea.

(3.7.51).—The patient was referred to Mr. J. Pike of Messrs. Rayner for investigation of visual aids. The graft was clear and through it could be seen anterior chamber details and two anterior synechiae; there was also a capsule anterior synechia. Mr. Pike was able to obtain 6/18 with a prism glass and J.3 with the addition of a collimating lens.

(2.1.53).—Visual acuity in the right eye with correction was 6/12 and J.8.

Result.—This patient subsequently returned to his studies at the Sorbonne and graduated as a doctor of philosophy.

(9.12.55). Visual acuity with a contact lens (Mr. F. Ridley) was 6/60, which could be improved to 6/18 with a telescopic lens.

(21.12.56) The patient was now an extra-mural lecturer in science. He had abandoned the contact lens as his corrected visual acuity was 6/18, and J.8 was obtained with telescopic correction. There was almost complete adaptation and the patient went about quite freely by himself.

The results in these cases would not have been possible without the able co-operation of my colleagues, G. Romanes and M. Garber, at East Grinstead. Sister C. King and her assistants were responsible for the skilled nursing which is so essential in corneal graft cases. I am indebted for the photographs to Mr. Gordon Clemetson of the Photographic Unit.

REFERENCES

- BÜRKI, E. (1947). *Ophthalmologica (Basel)*, **114**, 288.
 KRAUPA, E. (1914). *Zbl. prakt. Augenheilk.*, **38**, 132.
 MORAX, V. (1913). *Clin. ophthalm.*, **19** (n.s. 5), 108.
 PLANGE, O. (1908). *Klin. Mbl. Augenheilk.*, **46**(1) (n.s. 5), 277.
 POLGE, C., SMITH, A. U., and PARKES, A. S. (1949). *Nature (Lond.)*, **164**, 666.
 RYCROFT, B. W., ed. (1955). “Corneal Grafts”, pp. 12, 201. Butterworth, London.
 SACHS, A. (1957). *British Journal of Ophthalmology*, **41**, 552.