

16 mm PENETRATING SCLEROKERATOPLASTY

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INTRODUCTION

Penetrating keratoplasty has been used successfully to solve many corneal problems. There are other problems, however, in which the host bed (be it the limbus, cornea or sclera) is not fit to receive a donor cornea, due to a structural or functional compromise. Among them, we find staphylomas with sclerocorneal compromise, sclerocorneas, severe alcali burns, total leucomas (of different origin), sclerocorneal infections with corneal perforation, multiple previous rejections, etc.

Trying to find a solution for this problem, in 1980 L. Ruiz began performing 16 mm penetrating sclerokeratoplasties. Basically, this procedure consists of grafting a circular sclerocorneal segment, 16 mm in diameter. (Fig. 1). Some time later, the authors found in the literature that L. Girard¹ and D. Taylor² reported a related procedure, J. Barraquer³ also reported a 14 mm penetrating autosclerokeratoplasty. More recently, L. Girard⁴ presented a new group of 19 patients, in whom he obtained better results than those obtained previously.

Due to the reserved prognosis of this procedure, at first L. Ruiz selected only patients whose ocular globes were doomed for evisceration. In view of the good results obtained with the procedure, however, the group was enlarged to include patients with no immediate danger of evisceration, but whose structural compromise did not admit a traditional keratoplasty.

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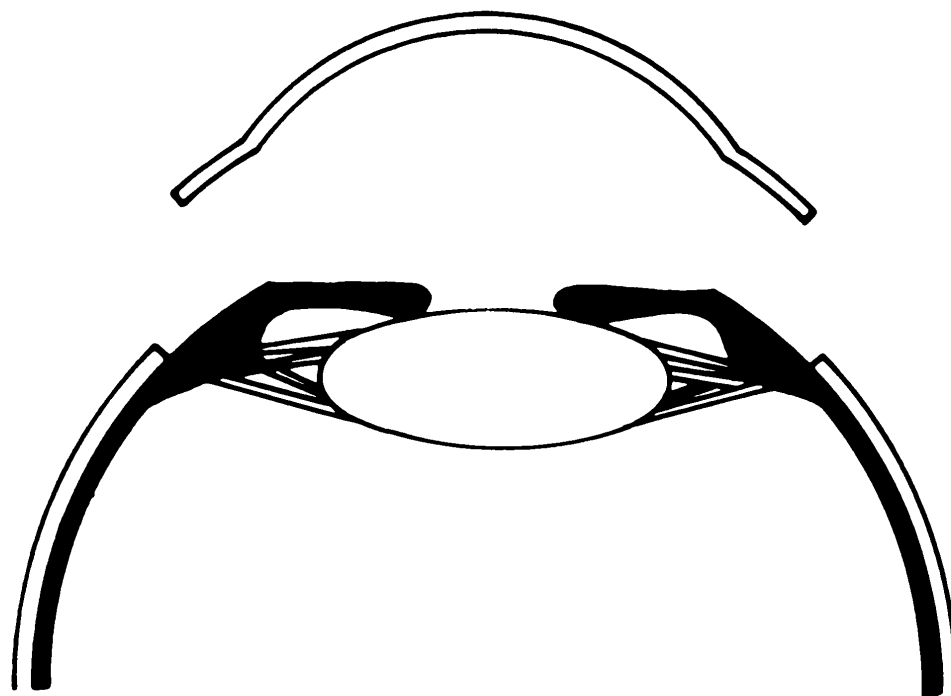


FIGURE 1

Sketch of the 16 mm penetrating sclerokeratoplasty

MATERIAL AND METHODS

A total of 33 reconstructive penetrating sclerokeratoplasties were performed in the eyes of 25 patients. The material used for the grafts was obtained from donor eyes that had been rejected for keratoplasty, due to their poor condition. Two of the patients of the group had bilateral surgery and 6 had a reoperation. From the 27 eyes operated, 8 had had a penetrating keratoplasty and 18 had had previous surgery of some kind. The average postoperative followup was 7 months (range: 1-27). The group was made up of 18 men and 7 women, whose ages ranged from 1 to 71, for an average age of 23.

For the study, the patients were divided into two groups, depending on the prognosis of ocular loss. The corresponding etiologic classification can be seen in table 1. The first group included patients in whom the surgery was performed to avoid imminent evisceration, due to perforation (sometimes with or following infection) (table 2), and the second group included patients with serious structural or functional sclerocorneal compromise, without immediate danger of evisceration (staphyloma-leucoma) (table 3).

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Table 1
16 mm PENETRATING SCLEROKERATOPLASTY
CLASSIFICATION BY GROUPS — 27 eyes

Group 1	Group 2	No. Cases
Imminent evisceration:		
Post ulceration		2
Post burns		2
	Staphyloma:	
	Post trauma	1
	Post ulceration	3
	Post surgery	1
	Total leucoma:	
	Sclerocornea	1
	Post surgery	8
	Post ulceration	4
	Post trauma	3
	Steven Johnson	1
	Post burns	1

Surgical technique

1. General anesthesia with etrane and miorelaxing agents, associated to retrobulbar injection with marcaine.
2. Peritomy of 360°, associated to 4 radial incisions in conjunctiva, to leave the anterior segment of the ocular globe well exposed . (Figs. 2, 3, 4).
3. Traction stitch in superior rectus. (Fig. 5).
4. An 18 mm flieringa ring is placed and fixed with 8 or more stitches. (Fig. 6).
5. A second 16 mm fliering ring is placed, well concentric with the sclerocorneal limbus, and fixed with 2 stitches. (Fig. 7).
6. With a razor blade, the segment to be resected is delimited along the inner edge of the ring, without reaching the uvea. (Fig. 8).

Table 2
16 mm PENETRATING SCLEROKERATOPLASTY
GROUP 1 - EYES DOOMED FOR EVISCERATION

Eye	Corneal pathology	Pre-served	Trans-parency	Intraocular Pathology	Graft pathology	V. A.	Followup (months)	Comments
1	Corneal staphyloma whit danger of perforation secondary to ulcerated corneal flap	Yes	I			20/20	27	
2	Perforated micotic ulcer	Yes	I			20/60	12	
3	Infected injury by alkali, which digestion of the conjunctival flap		III		Corneal ulcer		1	
4	Staphyloma with descematocele secondary to burn by alkali	Yes	I	Atrophy of II par by secondary glaucoma	Leucoma with des-epithelial-ization	L.P. L.P.	4* 2	Reoperation

* Total followup from first surgery

Table 3
16 mm PENETRATING SCLEROKERATOPLASTY
GROUP 2 - EYES UNIF FOR ROUTINE KERATOPLASTY

Eye	Corneal pathology	Pre-served	Trans-parency	Intraocular Pathology	Graft pathology	V. A.	Followup (months)	Comments
1	Sclerocornea	Yes	III	Iris cyst	Post trauma corneal ulcer	L.P.	22	
2	Corneal staphyloma post flap	Yes	I	RD	Ulcer and infection by C.L. EIR	L.P.	23*	Reoperation Amblyopia
3	Total leucoma + Secondary glaucoma	No	III	RD Pupillary membrane	Graft rejection + EIR	20/400	13	Reoperation Evisceration
		Yes	I			20/40	16*	Reoperation Associated IOL

* Total followup from first surgery

Table 3
16 mm PENETRATING SCLEROKERATOPLASTY
GROUP 2 - EYES UNIF FOR ROUTINE KERATOPLASTY

Eye	Corneal pathology	Pre- served	Trans- parency	Intraocular Pathology	Graft pathology	V. A.	Followup (months)	Comments
4	Microbacterial ulcer + 2 previous flaps	Yes	II		EIR	H.M.**	16	Postop herniated choroid + hypopion
5	Burn by alkali	Yes	III		EIR - donor eye in poor conditions	L.P.	2	
6	Penetrating corneal wound treated with conjunctival flap	Yes	III		Donor eye in poor conditions	L.P.	4	
7	Leucoma by repeated antiglaucomatose surgeries	No	III	Preoperative expulsive hemorrhage			14	Ptisis
8	Total leucoma second- ary to trauma	Yes	III		EIR-donor eye in poor conditions	L.P.	4	

** Hand movement

Table 3
16 mm PENETRATING SCLEROKERATOPLASTY
GROUP 2 - EYES UNIF FOR ROUTINE KERATOPLASTY

Eye	Corneal pathology	Pre- served	Trans- parency	Intraocular Pathology	Graft pathology	V. A.	Followup (months)	Comments
9	Total leucoma secondary to antiglaucomatose surgeries and PK with rejection	No	III	Preoperative expulsive hemorrhage			1	Ptisis
10	Adhering leucoma with ulceration (from childhood)	Yes	I			H.M.**	6	Amblyopia
11	Opacified graft + secondary glaucoma + megalocornea	Yes	II			L.P.	10	Hypotony Edema
12	Leucoma by several surgeries after corneal wound	Yes	III	Retroiridian plastron	EIR	H.M.**	11*	Reoperation After cataract
13	Giant staphyloma secondary to viral ulcer	No	II	Total RD		L.P.	4	Vitreous hema

* Total followup from first surgery

** Hand movement

Table 3
16 mm PENETRATING SCLEROKERATOPLASTY
GROUP 2 - EYES UNIF FOR ROUTINE KERATOPLASTY

Eye	Corneal pathology	Pre-Trans— served parency	Intraocular Pathology	Graft pathology	V. A.	Followup (months)	Comments
14	PK with rejection secondary to trauma, with repair	I		EIR	20/40	5	
15	Calcareous degener- ation secondary to trauma with repair	No III	Total RD			3	Ptisis
16	Steven Johnson	Yes II		EIR	H.M.**	4	
17	PK opacified after several surgeries post trauma. Previous RD surgery	Yes I	Retinal folds		L.P.	2	
18	Ulcer by exposition+ previous PK + tra- beculectomy	Yes II			L.P.	5	Vitreous hema

** Hand movement

Table 3
16 mm PENETRATING SCLEROKERATOPLASTY
GROUP 2 - EYES UNIF FOR ROUTINE KERATOPLASTY

Eye	Corneal pathology	Pre-served transparency	Intraocular Pathology	Graft pathology	V. A.	Followup (months)	Comments
19***	Total leucoma, secondary to viral ulcer	III		EIR	H.M.**	3	Age: 25 Reoperation
20***	Total leucoma, secondary to viral ulcer	Yes II Yes II	RD	EIR	H.M.**	5* 2	Amblyopia? Fellow eye of Patient 19 Amblyopia?
21	Several PK secondary to bacterial ulcer	Yes I			L.P.	2	Pigmentary retinitis
22***	Megalocornea, secondary to corneal smallpox?	Yes I			H.M.**	1	Donor epithelium not removed Nistagmus
23**	Megalocornea secondary to corneal smallpox? + previous surgery	Yes I	Optic atrophy		H.M.**	1	Fellow eye of Patient 22. Donor epithelium not removed Nistagmus

* Total followup from first surgery.

** Hand movement

*** Simultaneous bilateral surgery

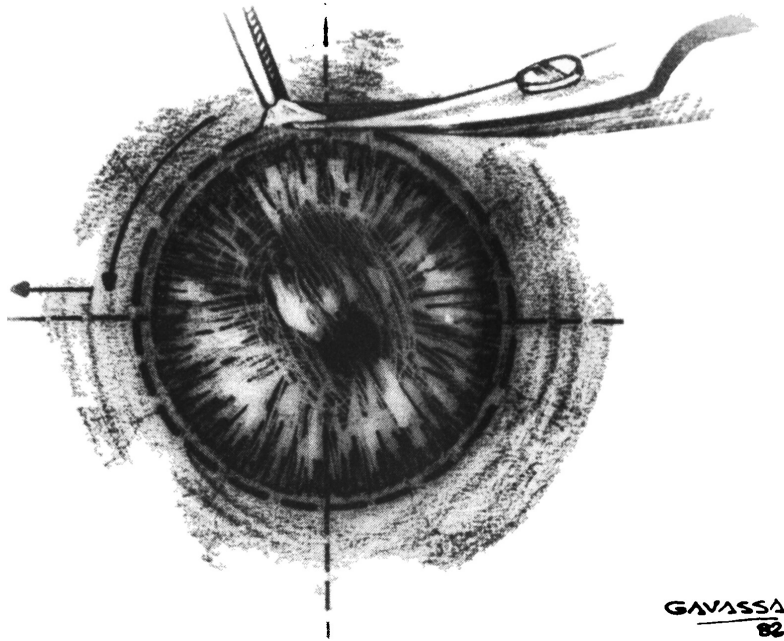


FIGURE 2
Peritomy of 360°.

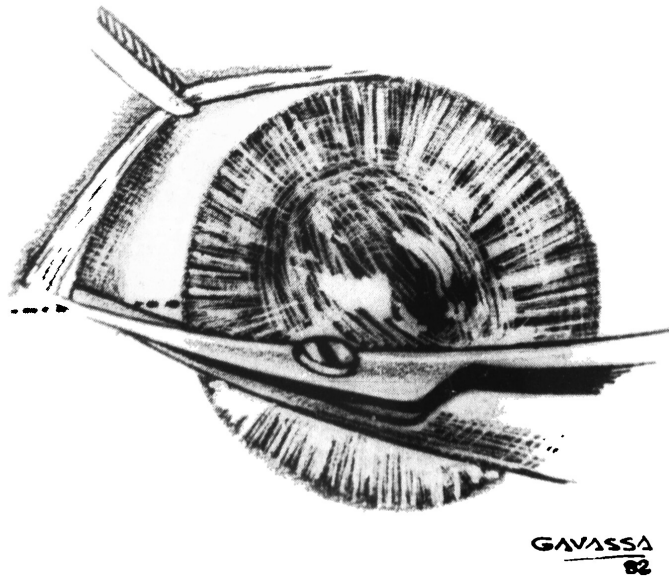


FIGURE 3
Four cardinal conjunctival incisions (4 mm)

16 mm PENETRATING SCLEROKERATOPLASTY

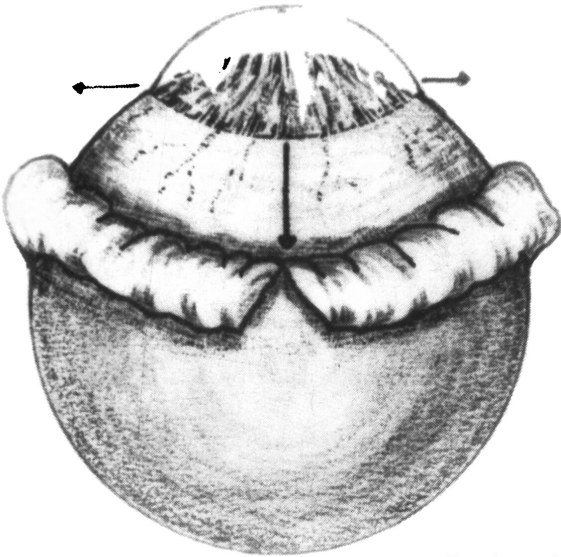


FIGURE 4

Dissection of conjunctiva and Tenon's capsule

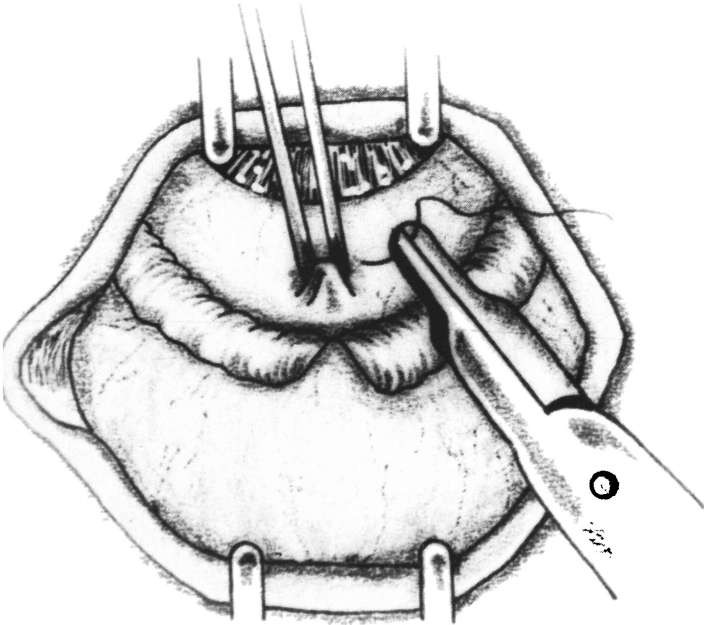
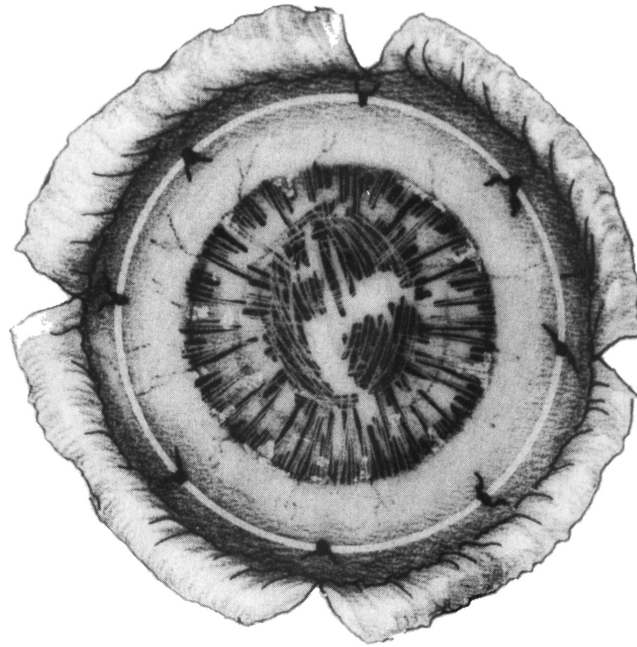


FIGURE 5

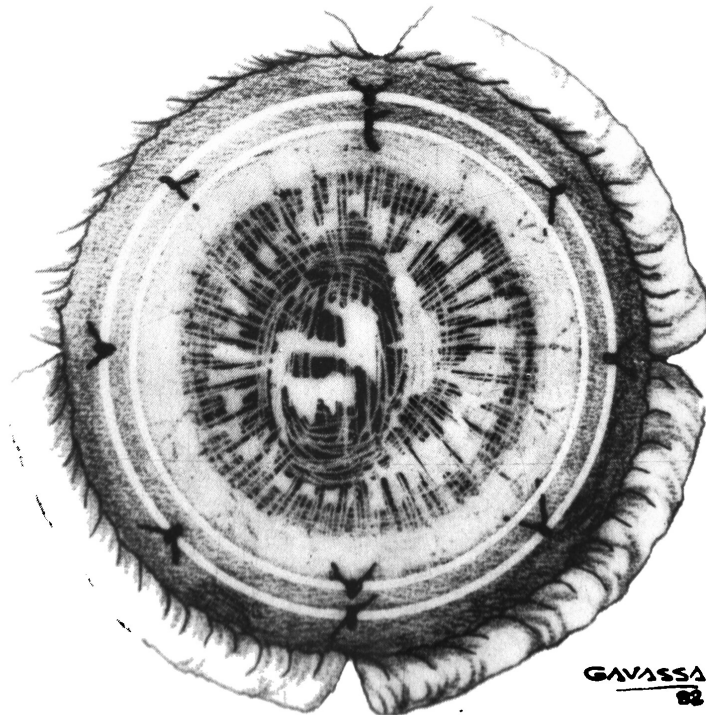
Superior rectus stitch with black 4-0 silk



GAVASSA
82

FIGURE 6

Placement of 18 mm fliering ring and fixation with 6-8 black 7-0 stitches



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FIGURE 7

Placement of 16 mm fliering ring and fixation with 2 black 7-0 silk stitches

16 mm PENETRATING SCLEROKERATOPLASTY

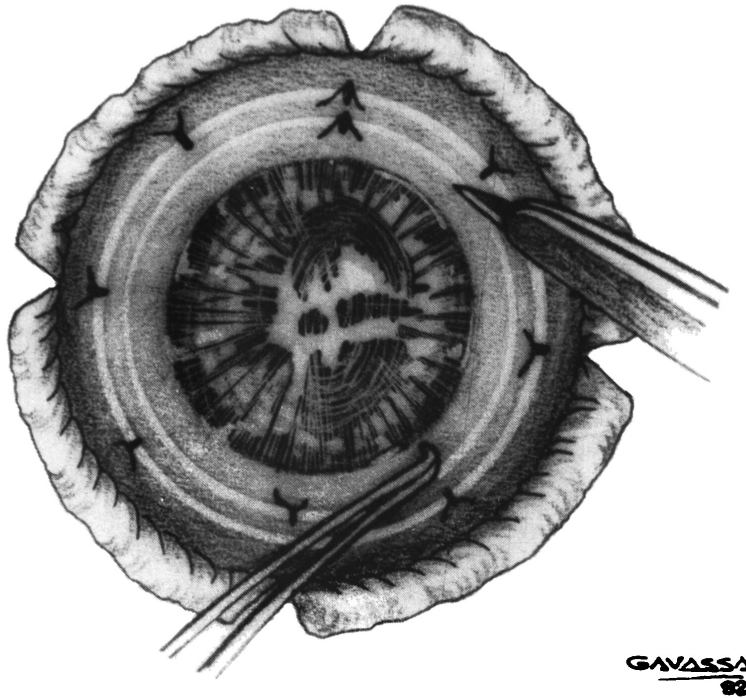


FIGURE 8

Scleral delimitation along inner edge of 16 mm ring, with blade

7. The 16 mm ring is removed and the incision is penetrated as far as the suprachoroidal space, with the same knife, along 3 or 4 mm. (Fig. 9).
8. The incision is finished with straight scissors, sectioning the sclera radially at the 360°. (Fig. 10).
9. The sclerocorneal cap is carefully dissected. This surgical step demands great care, especially on account of the frequent adhesences caused by the pathologic process. (Fig. 11).
10. If the lens is opaque, extracapsular lens extraction.
11. The lens remnants are aspirated.
12. Vitrectomy, if the eye was aphakic.
13. Eventual coreoplasty, whenever possible, or implantation of an intraocular lens, if the conditions of the anterior segment of the uvea allow it.

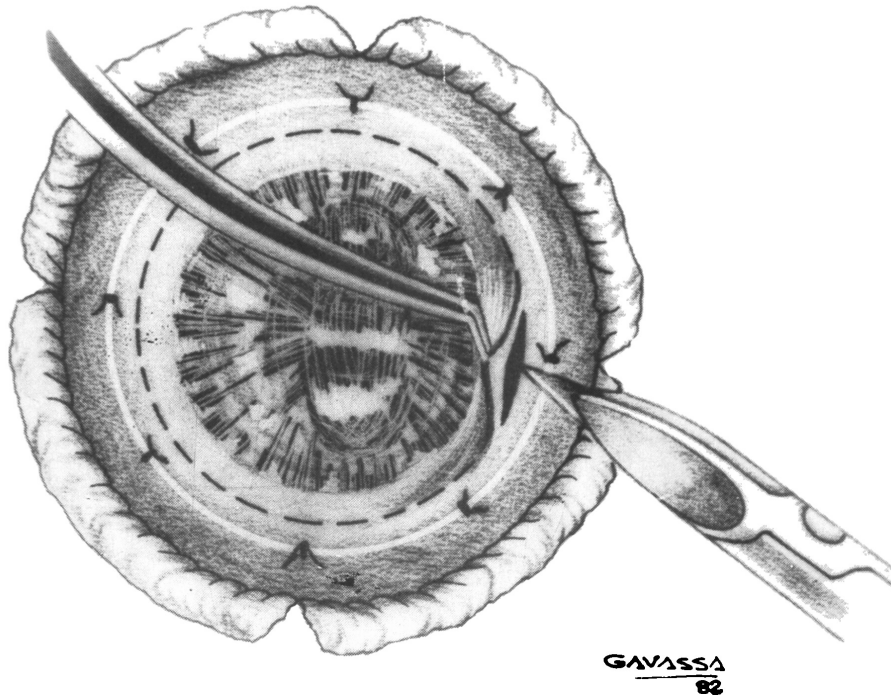


FIGURE 9

Removal of 16 mm flaring ring. Sclerotomy of ± 4 mm

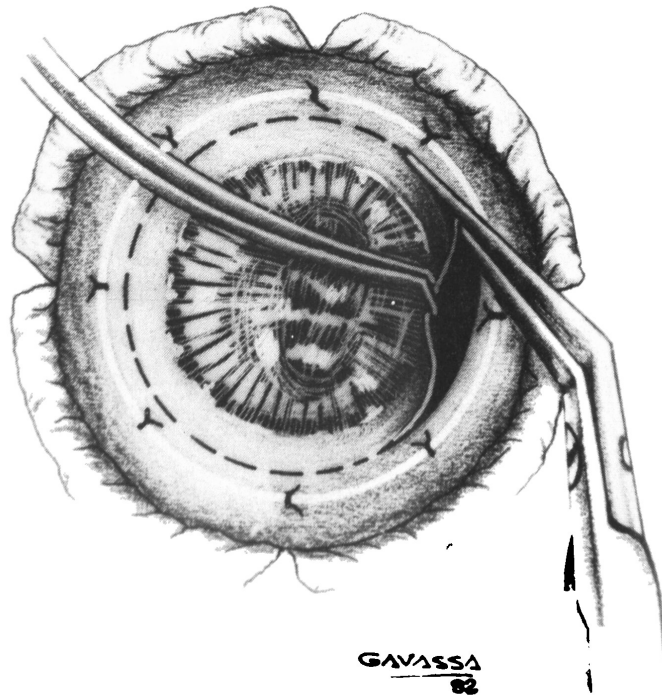


FIGURE 10

360° scleral cut with corneoscleral scissors

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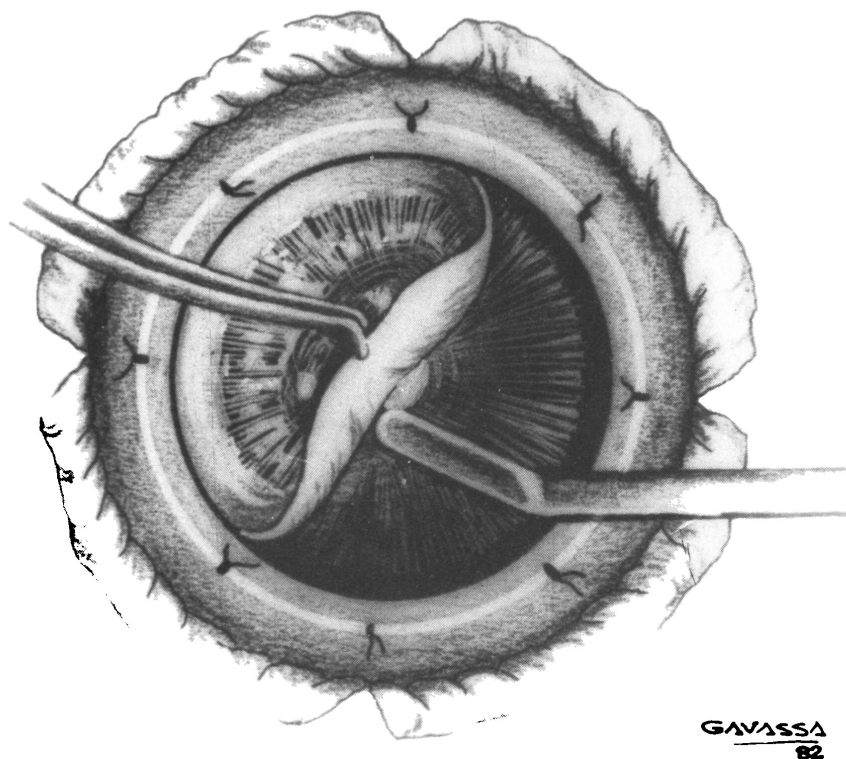


FIGURE 11

Dissection of ciliary body with spatula and vannas scissors. Performance of accessory procedures, depending on the case

14. The sclerocorneal graft is placed and sutured with 16-20 radial nylon 10-0 stitches. (Figs. 12, 13).
15. Removal of the 18 mm ring. (Figs. 14, 15).
16. Replacement of the conjunctival flap. (Figs. 16, 17).

In addition to the 16 mm penetrating sclerokeratoplasty, the following procedures were performed, when needed: vitrectomy (11), phacoextraction (11), anterior synechiotomy (6), posterior synechiotomy (4), total iris resection (2), iris suture (4), pupillary membrane extraction (3), total iris graft (1), choroir suture (1), IOL implant (1).

Postoperative control

During the postoperative period, three types of drugs were administered; a. Immuno-suppressives (imuran), b. Steroids (triamcinolone), c. Inhibitors of

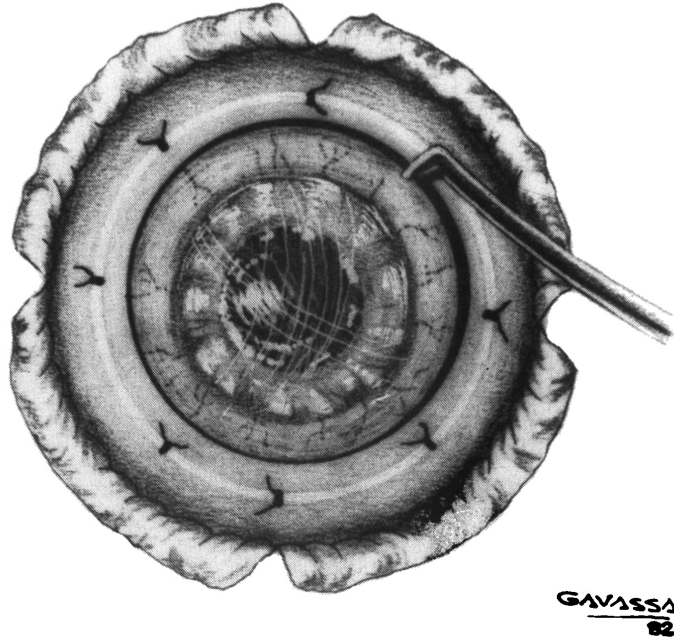


FIGURE 12

Placement of the sclerocorneal graft

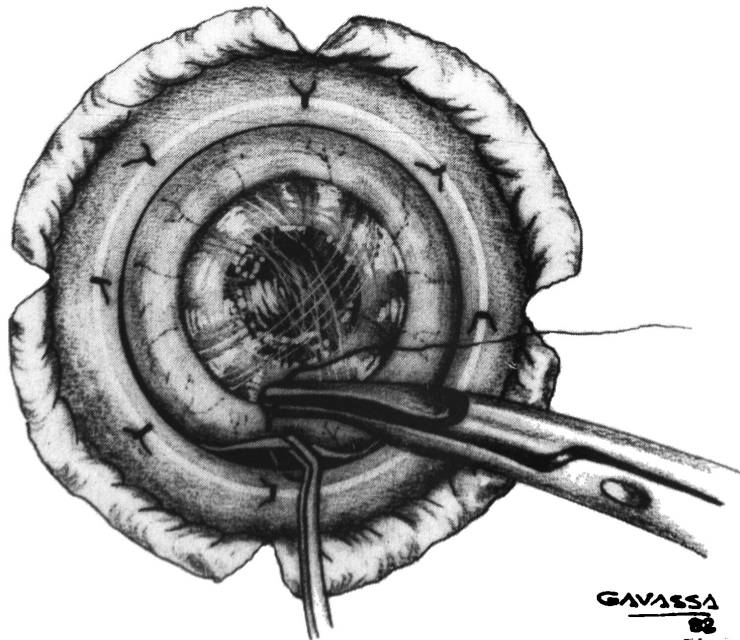


FIGURE 13

Fixation with 16-20 radial nylon 10-0 stitches.

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FIGURE 14
Sectioning of the stitches of the external ring.

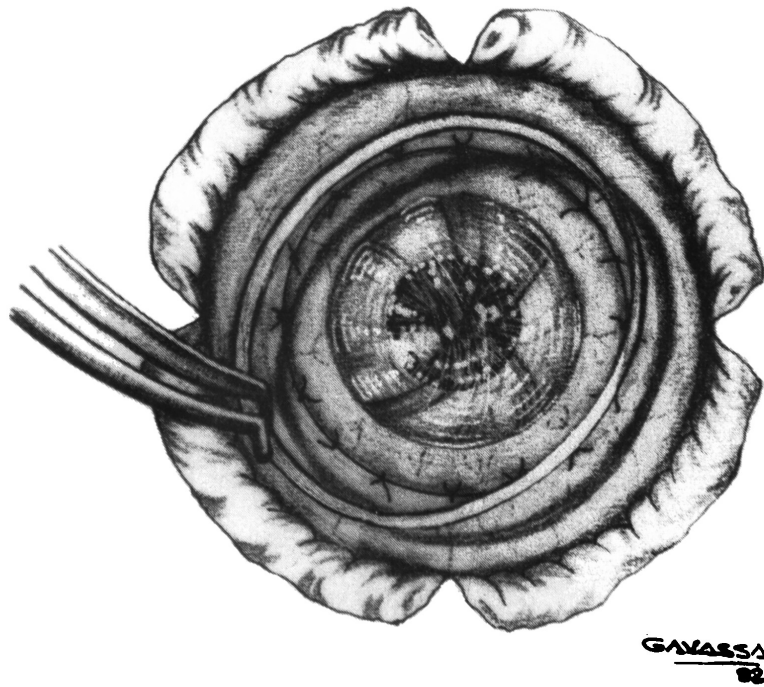


FIGURE 15
Removal of the external ring.

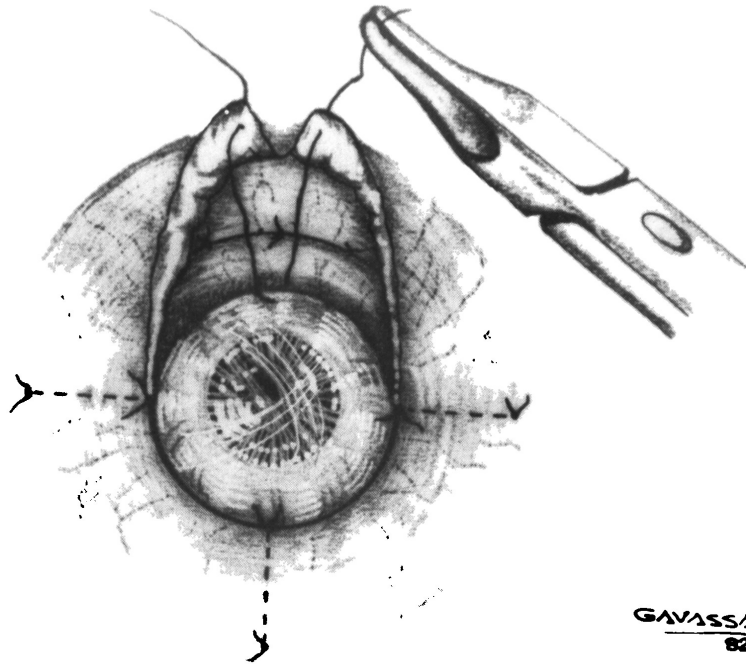


FIGURE 16

Reposition and conjunctival suture with 8 black 7-0 stitches

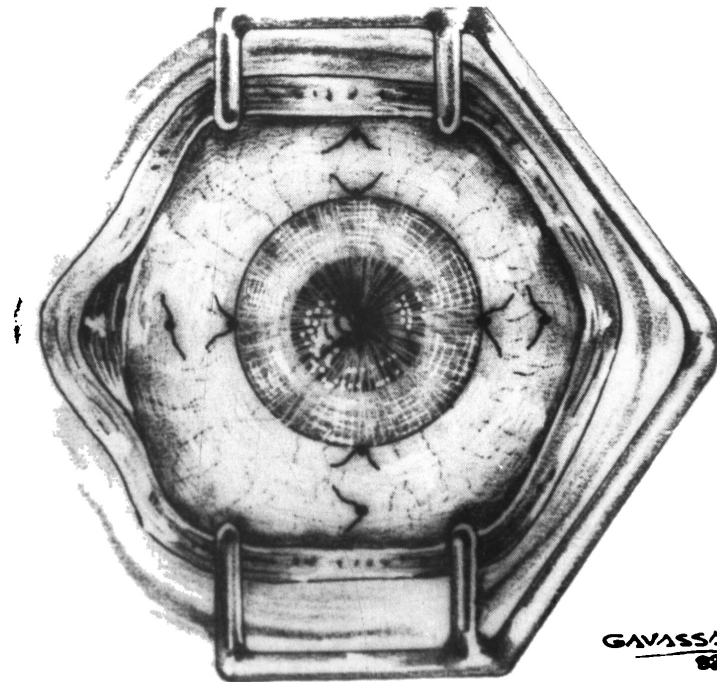


FIGURE 17

Final result

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carbonic anhydrase (acetazolamide or metazolamide), especially in the first cases of the series and only for the first postoperative days.

RESULTS

The results obtained with the surgery —namely, to preserve the eye and to restore the integrity of the anterior segment and vision— can be found in tables 2 and 3, respectively.

The degree of corneal transparency was appointed a Roman number. Thus, totally transparent corneas with a thickness of 0.60 mm or less were grouped as I, corneas with moderate edema and a thickness of 0.60–0.80 mm were grouped as II and corneas with great edema and a thickness over 0.80 mm were grouped as III.

From the 4 eyes of the first group, 3 cases (75%) had transparency I and 1 case (25%), which was reoperated, had transparency III in both operations (table 4).

Table 4
16 mm PENETRATING SCLEROKERATOPLASTY
COMPARISON OF TRANSPARENCY WITH V. A. - GROUP 1

Transparency	Cases	V. A.	Associated pathology
I	1	20 / 20	
I	1	20 / 60	
I	1	L.P.	Optic. atrophy
III	1	L.P.	Leucoma and removal of epithelium

From the 23 eyes of the second group (5 which were reoperated), 18 were preserved (79%). Nine of these cases and transparency I, 5 had transparency II and 4 had transparency III (table 5). The other 5 eyes presented ptisis bulbi (21%); of these, 3 had a total intraoperative RD and 2 had expulsive hemorrhage.

Postoperative complications

The most frequent postoperative complications were 10 epithelial immunoreactions (EIR) (30%), (Fig. 18), 9 hyphemas (27%), 7 hypotonies (21%), 2 corneal ulcers (6%), 2 graft rejections (6%) and 2 hypopions (6%).

Table 3

**16 mm PENETRATING SCLEROKERATOPLASTY
COMPARISON OF TRANSPARENCY WITH V. A. - GROUP 2**

Transparency	Cases	V. A.	Associated pathology
I	2	20/40	
I	2	H.M.*	Amblyopia
I	1	H.M.	After cataract
I	1	H.M.	Optic atrophy
I	1	L.P.	Retinal folds
I	1	L.P.	RD
I	1	L.P.	Pigmentary retinitis
II	2	H.M.	EIR
II	1	H.M.	EIR + amblyopia?
II	1	H.M.	Amblyopia?
II	1	L.P.	Vitreous hematoma
III	3	H.M.	Graft in poor conditions
III	1	H.M.	Vitreous hematoma

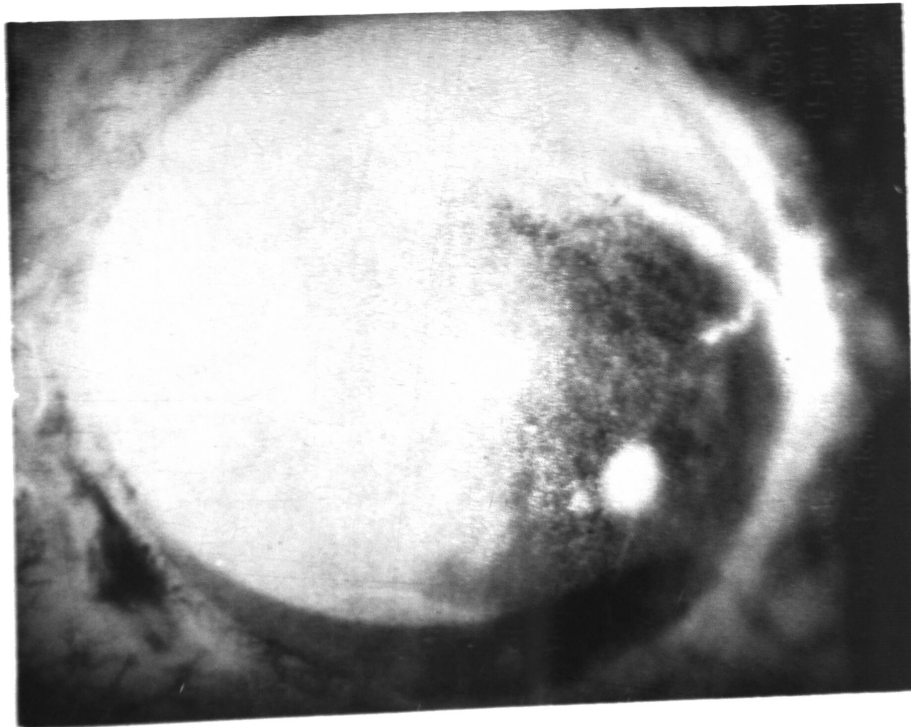
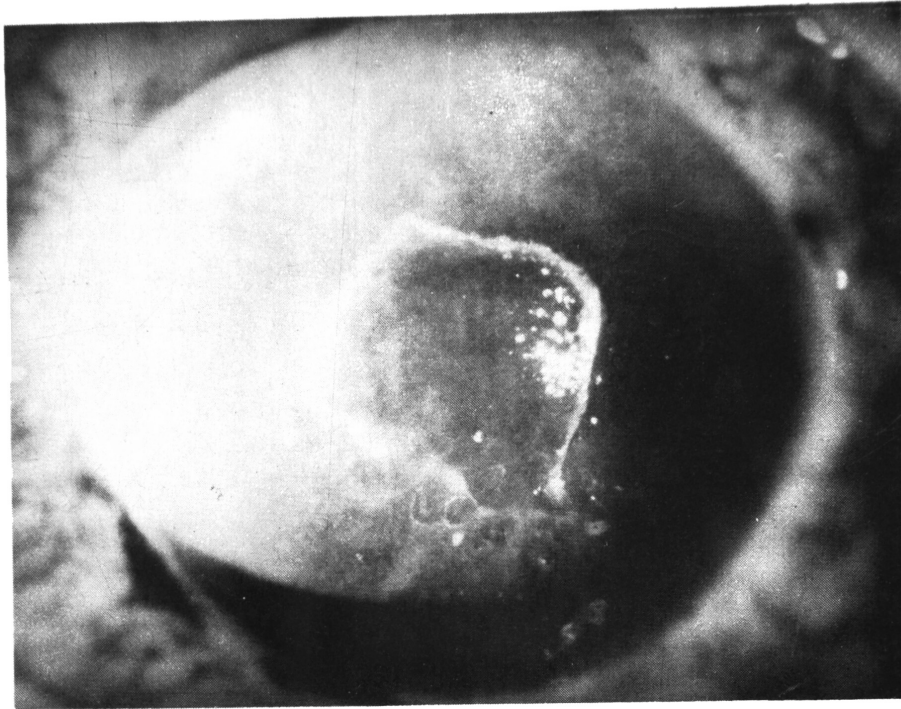


FIGURE 18

Case 4, table 3 4. Epithelial immunoreaction

16 mm PENETRATING SCLEROKERATOPLASTY



B. Same case, 3 days later

DISCUSSION

The results obtained with the 16 mm penetrating sclerokeratoplasties show this is a feasible alternative for the preservation or restoration of the ocular integrity. Moreover, if these results were possible even with the use of poor quality donor material, such as the one used in our series, even better results are to be expected with good donor material.

In the first group (eyes doomed for enucleation) the results are excellent, with 100% eyes preserved (Figs. 19, 20). Besides, 75% of them have a very satisfactory transparency and very good visual acuity.

Bearing in mind that a large number of eyes from the second group would be considered intractable, according to present surgical patterns, and that the original problem was long standing and generally associated to great intraocular problems, the 79% of cases in which the procedure produced an integral restoration is a very important factor, (Fig. 21). Moreover, the corneal transparency achieved in 77.7% of the preserved eyes should have permitted a satisfactory visual acuity, were it not for the intraocular pathology associated. On the other hand, taking into account the percentages of transparency

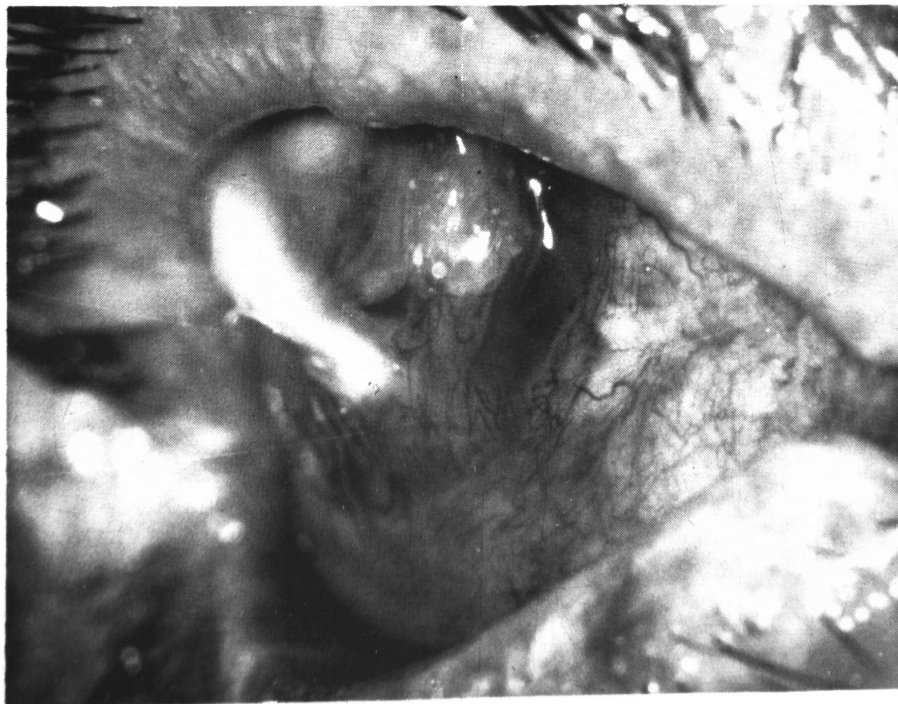
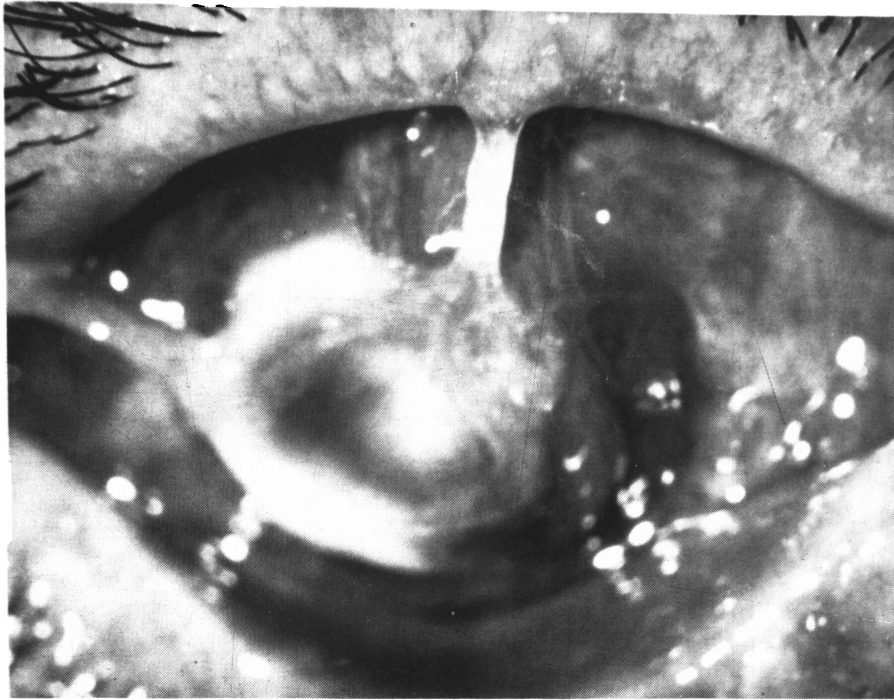
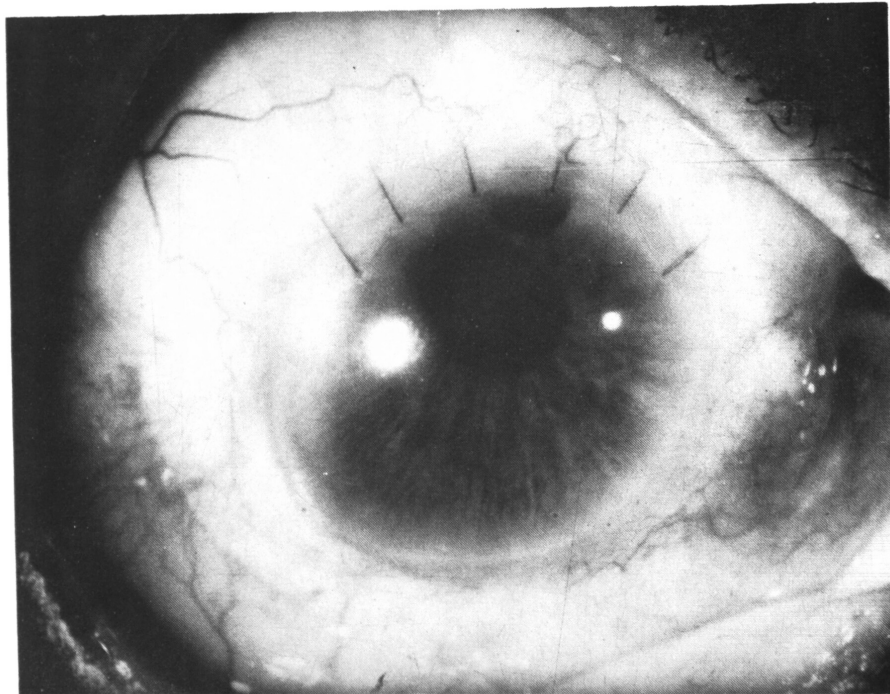
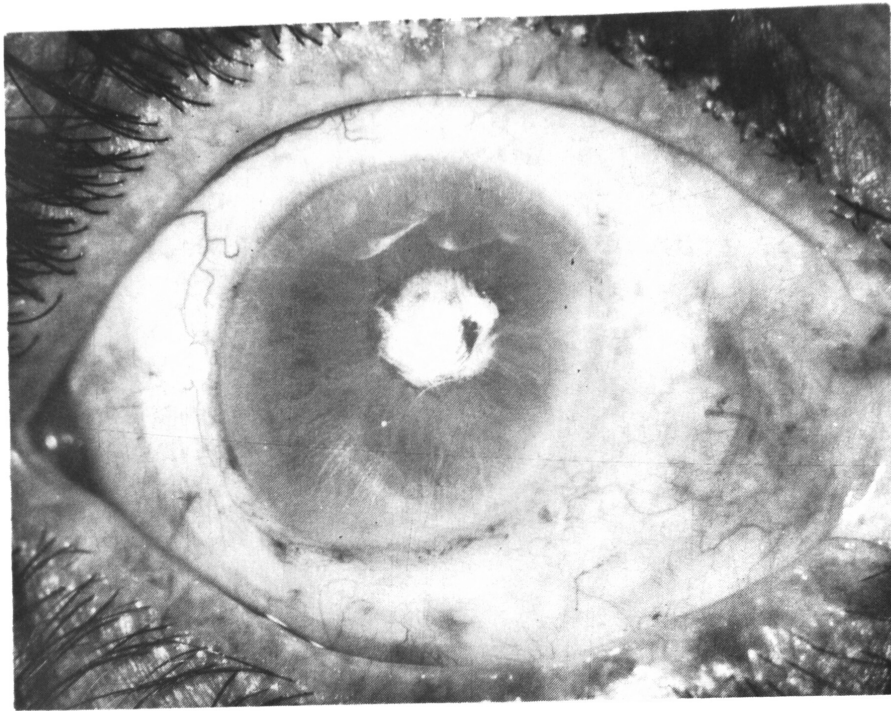


FIGURE 19

*Case 2, table 2 A. Perforated micotic ulcer. Front view.
B. Same case, side view*

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C. Same case. Cataract, 4 months after 16 mm penetrating sclerokeratoplasty.

D. Same case, 3 months after removal of cataract through the graft

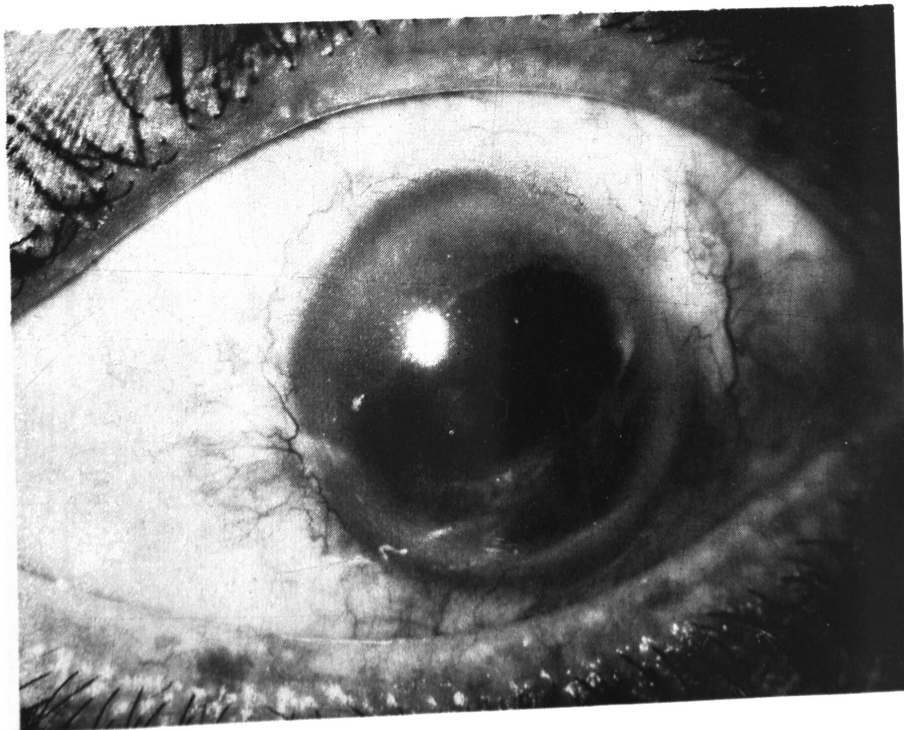
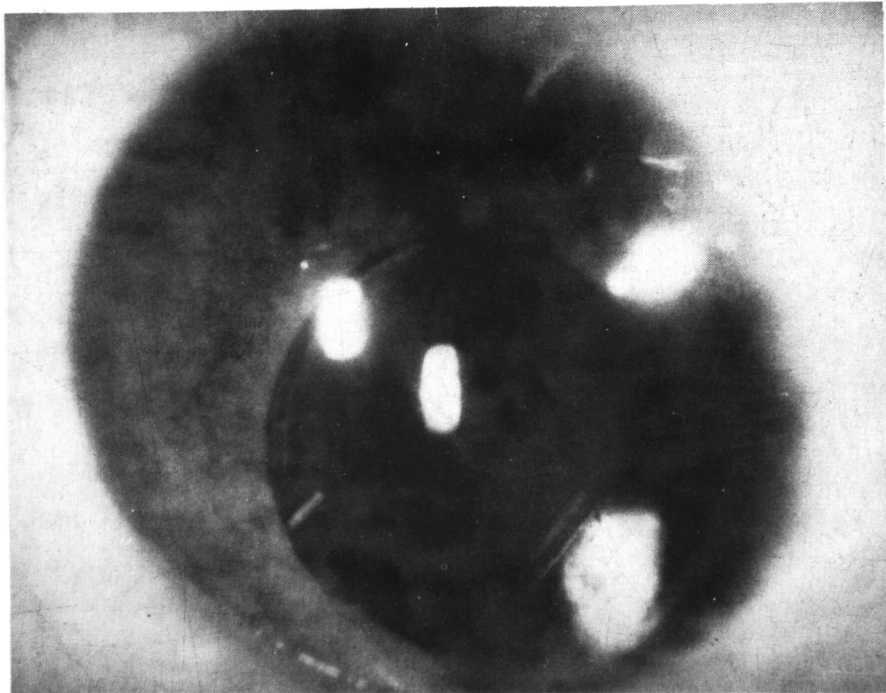
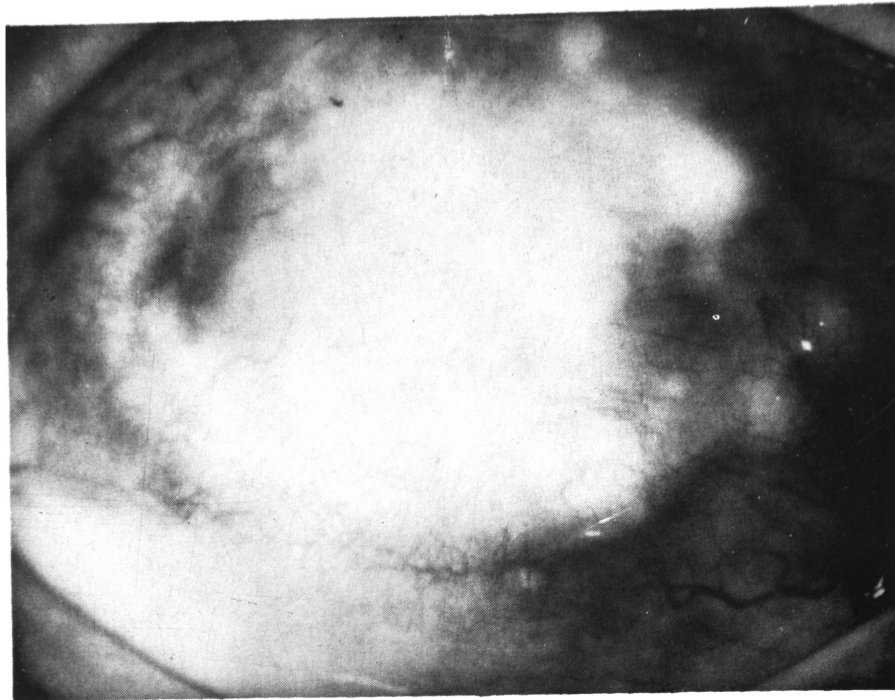


FIGURE 20

*Case 1, table 2. A. Giant infected corneal ulcer.
B. 27 months after 16 mm penetrating sclerokeratoplasty*

16 mm PENETRATING SCLEROKERATOPLASTY



*Case 3, table 3. A. Total leucoma + secondary glaucoma.
B. And C. 3 months after reoperation. See the IOL
implanted*



reached by the 5 patients that were reoperated (70% = I, 20% = II, 20% = III), a reoperation can be attempted in the remaining 27.3% of the group, in order to provided adequate transparency.

Worthy to be noted is the fact that the most frequent complication that occurred in the two groups was epithelial immunoreaction (EIR) (30%), as compared with only 6% of endothelial rejection.

L. Girard favors the routine use of a therapeutic contact lens, in spite of the frequent epithelial complications reported in his patients. The fact that 70% of our patients do not present this problem without the use of the lens and that the only lens used caused a bacterial ulcer opens up room for thought.

Since the etiology of the EIR is not very clear, we are, trying the following procedures to reduce or prevent it: a. The use of immunosuppressors, b. Permanent occlusion until there is total epithelialization, c. Leaving the donor epithelium (protecting it during surgery with Healon), d. Avoiding any corneconjunctival steps.

16 mm PENETRATING SCLEROKERATOPLASTY

The other problem in our series was postoperative hypotony (21%), which we believe may be due to poor scleral coaptation and a great postoperative ciliary depression or to the association of the procedure to a vitrectomy (42%). We believe the following steps will improve this condition: a. Trying to obtain a perfect coaptation between the graft and the bed, through the use of the same scleral trephine for both specimens and a better wound closure with additional stitches, b. Reducing the surgical trauma caused on the ciliary body, c. When necessary, the postoperative use of hypertensive substances and the use of Healon in the vitreous chamber when performing a vitrectomy.

So far, none of the patients of the series has shown a high intraocular pressure during the postoperative followup.

The advantages provided by 16 mm penetrating sclerokeratoplasties should be taken into account when evaluating a patient in need of a corneal graft. There are no endothelial wounds or stromal exposure (frequent causes of rejection). The absence of corneal sutures avoids neovascularization and prevents the resulting astigmatism and the trauma caused by the removal of the stitches. Moreover, the sclera acts like a barrier between the host and donor, reducing even more the possibility of rejection.

Our belief is that with the necessary improvements, this procedure will yield results that could turn it into a routine technique.

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