

The Triple Procedure
Basics And Difficult Situations
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Penetrating keratoplasty (PKP) a surgical procedure in which a diseased cornea is replaced by donor tissue.

Combined penetrating keratoplasty, cataract extraction, and lens implantation has been the treatment of choice for patients with combined corneal and cataract disease. The combined procedure reduces surgical and visual morbidity by reducing the number of procedures necessary to rehabilitate the eye and may be more effective than performing surgery in two or more stages. Early and recent clinical results have been extremely encouraging, as reported by multiple authors over the past 25 years

When a corneal transplant is necessary, in those who have a cataract, the cataract is generally removed concomitantly whether it is visually significant or not. There are several reasons for removing non significant cataract as it may progress rapidly after keratoplasty due to surgical manipulation and the use of topical steroid. Also post keratoplasty cataract surgery may traumatize the grafted healthy endothelium

Historical Review

Organ Transplantation

Zirm E 1906. *the first visually successful human penetrating corneal transplant was in Slovakia. by Dr. Eduard Zirm*

Combining cataract extraction and intraocular lens insertion with penetrating keratoplasty (the triple procedure) was first described by Taylor in 1976

The major indication for triple procedure is restoration of optical clarity in the presence of nuclear sclerosis or cataract;
the clinical situations encountered are the following:

- 1. Irregularity of the corneal surface (e.g., epithelial edema or scarring seen in some epithelial dystrophies).***

- 2. Abnormal corneal contour (e.g., keratoconus or healed stromal ulceration).***

- 3. Opacification of the stroma (as the end result of a wide variety of inflammatory or degenerative conditions).***

- 4. Thickening of the stroma secondary to edema with concurrent epithelial edema (Bullous keratopathy)***

Contraindications of triple procedure

Relative contraindications

***uncontrolled ocular cicatricial pemphigoid
infiltrative keratitis with corneal melting,
Patients with proliferative diabetic
retinopathy, uncontrolled glaucoma, and
severe uveitis***

***Patients with a history of severe herpetic
stromal keratitis or active keratouveitis***

***the only absolute contraindication to triple
procedure is when the surgical stress and
anesthetic risk which may increase
morbidity and mortality especially in
children who must be operated under
general anesthesia***

Combined Versus Single Procedures

When corneal transplantation and cataract surgery need to be performed for visual rehabilitation, a key strategic question is whether the procedures should be performed in one operation(combined surgery) or as two separate procedures(two step surgery)

The advantage of two separate operations is that the intraocular lens power calculation can be performed more accurately..

The disadvantages of two separate operations is that there is a risk of endothelial failure following cataract extraction.

Advantages of triple procedure

1) only one procedure, (2) less expense for one than for two separate procedures, (3) less risk to the endothelium of the graft from subsequent cataract surgery

Disadvantages of triple procedure

*The eye is open longer, the prolonged operating time increases the risk of posterior capsule rupture, vitreous loss, and expulsive hemorrhage
(2) The difficulty of accurately predicting the intraocular lens power*

IOL Power calculations

IOL formula used was SRK II Formula ($P = A - 2.5 L - 0.9 K$) where is;

P = IOL power

A = A constant 118

K average K reading.

L Axial length by A scan.

However the IOL power adjusted based on the refractive power of the fellow eye.

However, there remain no universally accepted formulas that will reliably predict an IOL power to produce emmetropia

Graft Size

In general, corneal grafts smaller than 6.5-mm may lead to irregularity of the graft margin, and irregularity of healing may all lead to astigmatism. On the other hand, grafts larger than 8.5 mm are more likely to lead to synechiae of iris to the graft-host margin or glaucoma so special considerations in graft size as followed.

Low myopia Punch > Trephine 0.5mm

Moderate myopia Punch > Trephine 0.25mm

High Myopia Punch = Trephine size

Donor Tissue Preparation

- (1) A uniform pressure should be applied to the endothelial surface to penetrate through the whole circumference;
- (2) The button should be kept moistened with Mc Carey-Kaufman (M-K) medium or balanced salt solution (BBB) or Optisol medium



Trephination of the donor cornea



Trephining the recipient cornea

(1) The recipient bed must be round and regular to decrease the postoperative astigmatism,

(2) Maintaining the trephine perpendicular to the cornea to achieve centrality of the trephination,

(3) It is unwise to enter the anterior chamber with a trephine, entrance into the anterior chamber is most safely achieved by a sharp blade thus creating a host posterior bevel

(4) The initial opening in the anterior chamber (AC) should be sufficiently long that a scissors blade may be easily passed through it

Some surgeons prefer to centre the trephine slightly nasally because (1) the pupil is often normally displaced nasally, (2) a slightly inferonasal displacement of the cut conforms better to near vision

A limbal paracentesis incision is made between suture marks, and a moderate amount of viscoelastic is injected to protect the intraocular structures from the cutting action of the trephine blade

Graft size was 0.25– 0.50 mm larger than recipient bed. Ranged (7.5–8.5) 0.25 larger in keratoconus ,0.5mm larger in other corneal diseases and Host bed 7–8 mm.

IOL Power Depend on:

- ▶ Refractive status of the fellow eye as axial length and K- reading.
- ▶ Previous History of the refractive power of the diseased eye before corneal disease as previous glass.
- ▶ Average keratometric measurement.

Surgical Techniques

- ▶ Preparation

On the day of surgery, pupillary dilatation and A topical nonsteroidal anti-inflammatory drop can also be used to prophylax against premature intraoperative miosis.

How to decrease the vitreous pressure

- ▶ Careful patient positioning
- ▶ Preoperative external ocular massage
- ▶ Administration of hyper osmotic agent as manitol 20% 5ml per kg
- ▶ Proper eyelid speculum selections
- ▶ Filinga ring may be applied and sutured in the sclera to prevent globe collapse after cataract extractions

Steps of surgery

- ▶ *Marking the cornea by marker*
- ▶ *Trephination of the donor cornea by Hess–Burg Barron trephine*
- ▶ *paracentesis*
- ▶ The recipient cornea was trephined to 50–80% depth by using (*Hess burg–Barron disposable suction trephine*).

In cases of keratolenticular adhesion or anterior synechiae, the lens or the iris was carefully peeled off the cornea

. After entering the anterior chamber, careful excision of the button with curved corneal scissors

- ▶ injection of viscoelastic over the lens and cataract extraction was performed by using the typical capsulorhexis which should be as large as possible or large can opener capsulotomy was created using 27 gauge needle

Then the nucleus simply expressed by hydro dissection of the lens or use of cystitome to extract the nucleus,
Manual irrigation / aspiration of the cortex was done.

Then the IOL placed in the capsular bag (6.5 mm PMMA hard IOL with 13 mm length

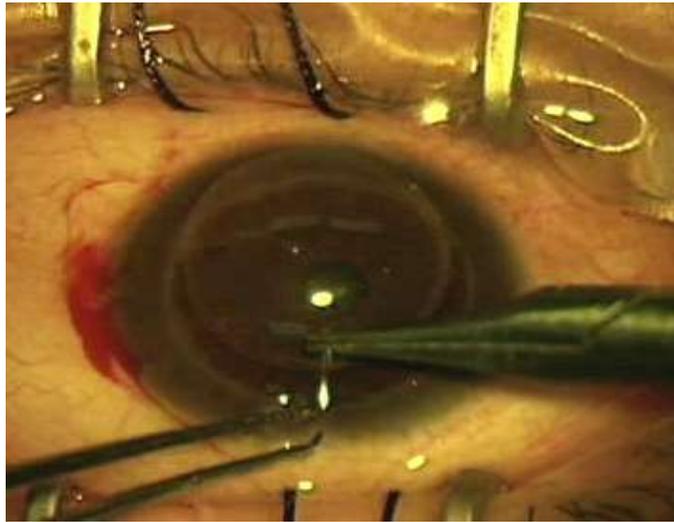
After that the pupil was constricted with 1% acetylcholine chloride

Grafts were sutured by a combined interrupted/continuous technique of 8 interrupted 10/0 Nylon sutures and a single continuous suture.

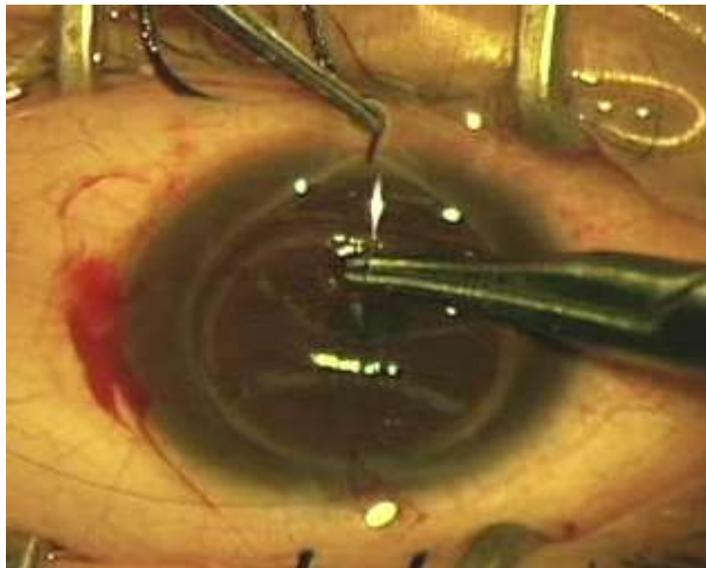
Suturing of the graft

- ▶ The primary fixation of the graft is usually by four interrupted cardinal sutures of 10-0 nylon placed 90 degree apart.
- ▶ The positioning of the second suture is particularly critical; because it determines the symmetric geometry that is helpful in eliminating astigmatism. After the four cardinal sutures have been placed, various techniques can be used to fixate the graft: Some surgeons prefer to use 8 or 16 symmetrically interrupted sutures and then a continuous running suture of 10-0 nylon. Still other surgeons fixate the graft with interrupted sutures, then perform either a single or double running sutures of 10-0 nylon





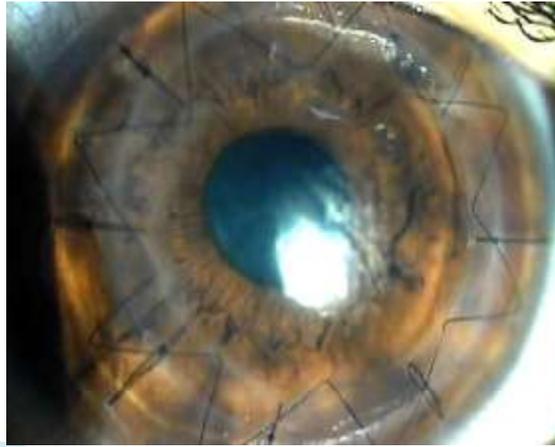
1st suture (12 o'clock



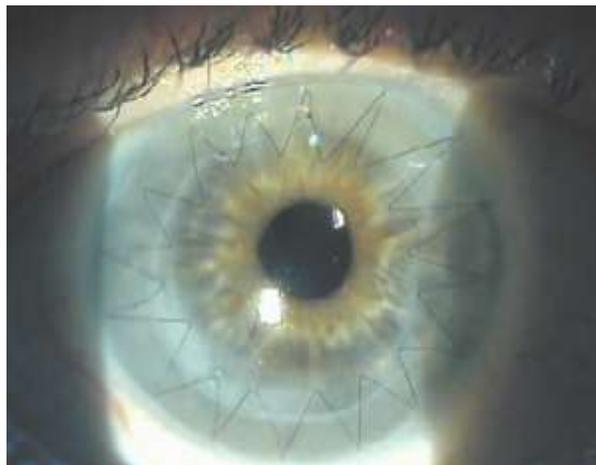
(6 o'clock) 2nd suture

Types of sutures

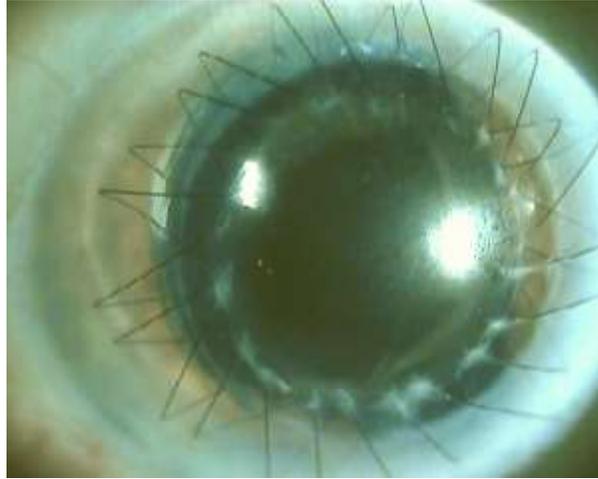
(1) 8 interrupted + 12 bit continuous



Long continuous Suture



Double Running



Interrupted sutures





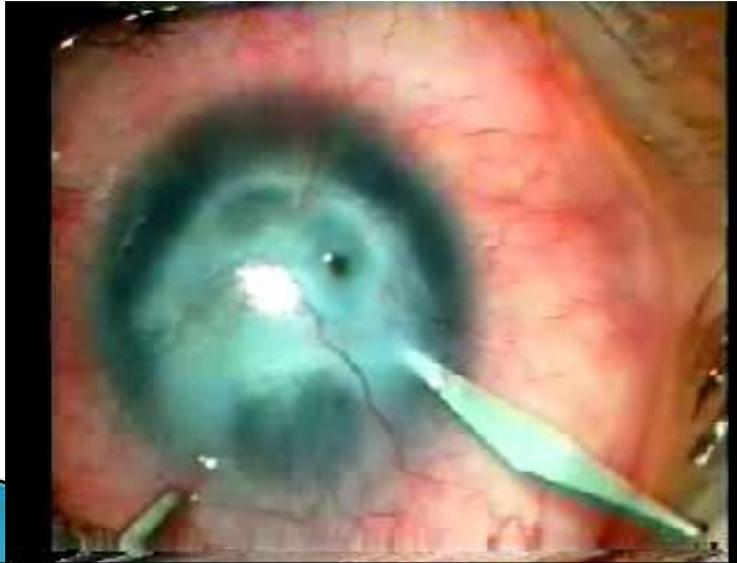
Combined Penetrating Keratoplasty and Cataract Surgery
Lucas Shiokawa, M.D.



Postoperative tippel procedure



Redo after failure with rupture post capsule



Post rejection triple procedure (redo) (*postoperative*)



Descematocele with iris sutures



Postoperative evaluations

- *Patients were examined for signs of complications on days 1, 7 and 1, 3, 6, 12, 24 months postoperatively.*
- In each visit, the evaluation including the following:*
- *BCVA.*
 - *Slit Lamp examination to evaluate graft clarity, presence of allograft rejection, presence of reaction, infection position of the IOL and PCO.*

IOP measurement by Applanation tonometer or air puff tonometer

If elevated, medical treatment was started initially and if not controlled medically surgical treatment may be indicated

- **Keratometry and corneal topography** done for detection of degree of astigmatism and for selective suture removal

Graft evaluation

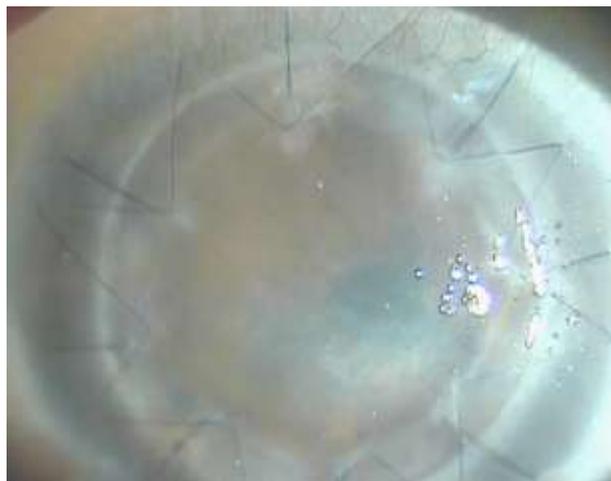
A clear graft was defined as one with compact central stroma, without epithelial or stromal edema, that allowed a clear view of iris details

Graft Rejection

Allograft rejection was diagnosed when sudden loss of graft clarity was associated with inflammation in a previously clear graft, 2 weeks after surgery. also in the presence of an endothelial or epithelial rejection line.

- ▶ ***A secondary graft failure*** was defined as an irreversibly edematous and opaque cornea after the graft was initially clear 2 weeks after PKP.
- ▶ A graft failure was considered an immunologic graft failure in presence of the following criteria: ciliary injection with cells in the anterior chamber, retro corneal precipitates with or without stromal edema, and endothelial rejection lines.

Rejection



Graft failure



Home Massage

Triple procedure is a good surgery to regain useful vision for patient with different corneal disease and cataract and indicated for all patients who had cataract combined with corneal diseases such as Fuch's endothelial dystrophy, different types of corneal scarring such as post traumatic or due to healed corneal ulcers or herpetic scarring, also in keratoconus where combined with cataract, also any types of corneal diseases leads to opacification of the cornea when combined with any degree of cataract.

During The Triple Procedure :

- ▶ Honnan Balloon
- ▶ Max. mydriasis
- ▶ Fast manipulation
- ▶ Meticulous Lens matter cleaning

Avoid and Take care

Lens Induced Glaucoma

2nd intervention = Endoth. Injury

After cataract = Inflamm. Reaction.

Miosis

- ▶ IOL Miss Calculation
- ▶ Tedious surgery
- ▶ More complications

