

Pars Plana Vitrectomy and Penetrating Keratoplasty Combined With Temporary Keratoprosthesis in Traumatic Cases

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ABSTRACT

Purpose: To evaluate the functional and anatomical outcomes of patients underwent combined pars plana vitrectomy (PPV) and penetrating keratoplasty (PKP) using temporary keratoprosthesis (TKP) for vitreoretinal pathology and corneal opacities secondary to severe ocular trauma.

Materials and Methods: Medical records of participants that underwent combined PPV and PKP surgery with TKP for severe eye trauma were retrospectively analysed. During the follow-up, functional success (best corrected visual acuity (BCVA)) remained the same or increased, and anatomic success (retinal reattachment, graft transparency) and complications were evaluated.

Results: Twenty-two eyes of 22 patients (mean age 43.40±22.43 years, 15 male/7 female) were included in this study. The mean follow-up period was 12±7.8 months. At the last follow-up, BCVA increased in 3 patients (13.6%) and remained unchanged in 16 patients (72.7%). Two of 3 patients had decreased BCVA with LogMAR chart from 2.10 to 3.10 logMAR, while 1 patient had decreased from 3.10 logMAR to loss of light sensation (13.6%). At the last follow-up, the retina was attached in 16 patients (72.8%). Corneal graft remained transparent during follow-up in 12 patients (54.5%), while graft failure was seen in 10 eyes (45.5%).

Conclusion: PPV and PKP surgery combined with TKP is an alternative method for patients with corneal opacities that not allowed to vitrectomy. Although retinal reattachment is achieved in the majority of patients, corneal graft failure is a common postoperative complication. Patients should be informed about the long-term functional outcomes of this complicated surgery.

Key Words: Temporary keratoprosthesis, pars plana vitrectomy, penetrating keratoplasty

INTRODUCTION

In cases with vitreoretinal pathology associated with corneal opacity, pars plana vitrectomy can be performed endoscopically or using a temporary keratoprosthesis (TKP).¹ Combined penetrating keratoplasty (PKP) and pars plana vitrectomy (PPV) with TKP allows adequate visualization of intraocular tissues.²

Combined PKP and pars plana vitrectomy with TKP a severe surgical procedure. This procedure is performed in patients with severe corneal opacity and posterior segment pathology. The advantage of temporary keratoprosthesis is that it provides a wide visual field, bimanual surgery,

stereopsis and a surgical environment as in standard vitreoretinal surgical procedures.³

Landers et al. reported the first PPV with TKP in 1981.⁴ This keratoprosthesis used PMMA material; Landers TKP does not leak while indenting and is reusable.⁴

We are currently using Landers TKP in our clinic. Co-treatment of anterior and posterior segment pathologies is often a complex procedure and requires a multi-disciplinary approach. In this study, we discussed the cases of combined TKP / PPV / PKP in the surgical treatment of vitreoretinal pathologies coinciding with corneal opacity after trauma.

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MATERIALS AND METHODS

Twenty-two eyes of 22 participants that underwent combined TKP / PPV / PKP surgery between January 2016 and May 2019 at Istanbul Beyoglu Eye Training and Research Hospital were included in the study. The study was prepared according to the principles of the Declaration of Helsinki. This retrospective observational study was approved by the ethics committee of Okmeydani Training and Research Hospital (ref. no.1384). Opacity score of cornea was classified as follows: 0, no opacity; 1, smaller than one-third of the corneal surface was clouded; 2, less than two-thirds clouded; 3, more than two-thirds clouded; and 4, almost all the corneal surface clouded and the opacity prevented visualization of the pupil margins.⁵

Inclusion criteria were the history of open globe injury and a follow-up period of at least 6 months. In all patients, corneal opacity score was 4 and primary suturation was performed as an emergency procedure; TKP / PKP / PPV was consecutively performed at another session. In the preoperative examination, age, gender, visual acuity, intraocular pressure and history of ocular injuries and BCVA were recorded, and a B-scan ultrasonography was performed. As the initial and final visual acuities were poor, the visual acuities of the patients were reported as hand motion (HM), finger counting (FC) and no light perception (NLP) forms.

Data of ocular trauma included the mechanism and type of injury classified according to the Ocular Trauma Classification.⁶ The ocular injury was classified as Zone I, II or III depending on the location of the wound according to the cornea or sclera. Zone I injuries are confined to the cornea, Zone II injuries involve the anterior sclera up to 5 mm from the limbus and Zone III injuries affected full-thickness scleral defects more than 5 mm from the limbus.⁶

Postoperative examination revealed visual acuity, intraocular pressure, corneal graft status and retinal detachment. The best corrected visual acuity (BCVA) and anatomical results (retinal detachment, corneal graft transparency, intraocular pressure) were measured.

Surgical techniques

The patients underwent general anaesthesia, and a standard three-entry 23G vitrectomy was performed. The Flieringa ring was sutured to the sclera with 7/0 silk sutures. The recipient cornea was cut in half through a 7.5-mm disposable trepan. The anterior chamber was entered with a 15-degree blade, and the cornea was cut with the help of corneal scissors. Landers-type transient keratoprosthesis was sutured to the peripheral cornea from 4 quadrants with 7/0 vicryl to the recipient cornea (Figure1: A, B).

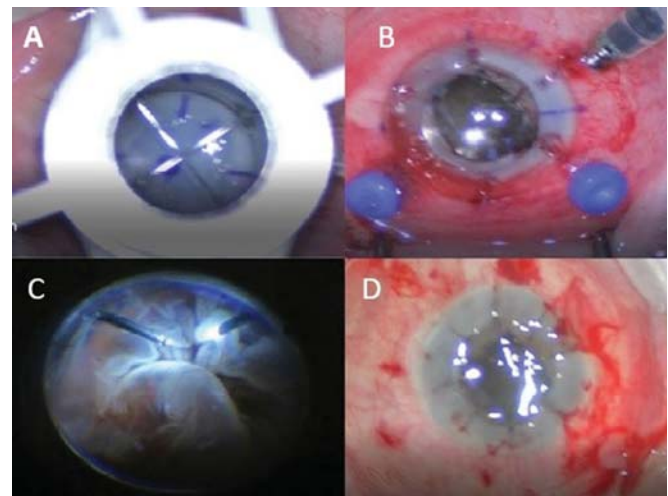


Figure 1. (A) Trephining the cornea (B) Wide-field temporary keratoprosthesis sutured to the corneal bed (C) Performing pars plana vitrectomy (D) Donor cornea was sutured.

Subsequently, core vitrectomy was performed. As the choroid was thick, a 6-mm infusion cannula was used. After 23G pars plana vitrectomy was completed, the temporary keratoprosthesis was removed, and the donor cornea was cut with a 7.5-mm trepan and sutured to the recipient bed by interrupted suturing techniques. Sclerotomy sites were closed with 7/0 vicryl (Figure1 C, D).

Combined penetrating keratoplasty and vitrectomy using temporary keratoprosthesis might be preferred because of the ease of intraocular surgical manipulation and early visual rehabilitation.

RESULTS

Twenty-two eyes of 22 patients were included in this study. Of the patients included in the study, 15 were male and 7 were female. The mean age of the patients was 43.40 ± 22.43 years (range 7-78 years). The mean follow-up period was 12 ± 7.8 months (range 6-33 months). The first surgical cause was trauma in all patients. Retinal detachment in 16 patients (72.7%), endophthalmitis in 4 patients (18.2%) and intraocular lens (IOL) posterior luxation in 2 patients (9.1%) were the causes of surgery with TKP. Wound location was classified according to Ocular Trauma Classification Group as Zone I in 3 eyes, Zone II in 9 eyes and Zone III in 10 eyes. At the last follow-up, BCVA increased in 3 patients (13.6%) and remained unchanged in 16 patients (72.7%). Two of 3 patients had decreased BCVA with LogMAR chart from 2.10 to 3.10 logMAR, while 1 patient had decreased from 3.10 logMAR to loss of light sensation (13.6%). At the time of surgery with TKP, 10 patients were aphakic, 5 patients were phakic and 7 patients were pseudophakic. At the last follow-up,

retinal attachment was observed in 16 patients (72,8%), retinal detachment (27.2%) was accepted as inoperative in 6 patients and phthisis bulbi (4.5%) in 1 patient. During follow-up, corneal graft remained transparent in 12 eyes (54.5%), while graft failure was observed in 10 eyes (45.5%) (Table 1).

In patients with graft failure, recurrent PKP was not performed because it had no effect on visual acuity increase (due to retinal problems and phthisis). As an intraocular tamponade, silicone oil was used in 17 patients (77.2%), fluid in 4 patients (18.1%) and perfluoropropane (C3F8) in 1 patient (4.5%). In 5 patients (22.7%), silicone was removed after an average of 6.2 ± 2.4 months, and at the

last follow-up, recurrent retinal detachment was seen in 3 patients (13.6%).

DISCUSSION

In patients with corneal opacity and vitreoretinal pathology, pars plana vitrectomy is possible either endoscopically or with TKP. While the advantages of endoscopic imaging assisted vitrectomy is early intervention and lower surgical time, the disadvantages of this technique are the lack of stereopsis and the inability to perform bimanual surgery.^{1,7} TKP provides a large visual field, good stereopsis and bimanual surgery, unlike endoscopic surgery.⁷ In our study, TKP with Landers wide angle keratoprosthesis performed

Table 1. Patients' General Characteristics.

No	Age y	FU mo	Months from primary suture	Zone	Lens status	Base line VA	Last VA	Tamponad	Graft clarity	Retinal attachment	Complications	Additional surgery
1	78	9	4	I	Aphakia	HM	HM	5000csSO	Yes	Yes	-	SO Removal
2	8	12	1	II	Pseudophakia	HM	HM	5000csSO	No	No	PVR,Graft failure	Endoscopic surgery
3	46	33	6	I	Aphakia	0,016	0,1	C3F8	Yes	Yes	Prephthisis	-
4	53	7	1	III	Aphakia	FC to 50cm	FC to 50cm	5000csSO	No	Yes	Graft failure	SO Removal
5	32	8	72	III	Pseudophakia	HM	NLP	5000csSO	Yes	Yes	Phytisis	-
6	38	16	1	II	Phakic	HM	HM	5000csSO	Yes	No	Hypotony	-
7	36	17	96	II	Pseudophakia	HM	HM	5000csSO	No	No	PVR,Graft failure	Endoscopic surgery
8	45	6	1	III	Phakic	FC to 50cm	0,03	BSS	Yes	Yes	-	-
9	69	24	11	II	Aphakia	HM	HM	1000csSO	No	Yes	Graft failure	SO Removal
10	69	18	9	II	Pseudophakia	HM	HM	1000csSO	Yes	Yes	Subretinal dekalin	SO Removal
11	8	12	7	I	Phakic	HM	HM	1000csSO	No	Yes	Graft failure	SO Removal
12	44	24	24	III	Phakic	HM	HM	1000csSO	No	Yes	Graft failure	Endoscopic surgery
13	22	6	12	II	Phakic	HM	HM	1000csSO	Yes	Yes	PVR	PPV
14	46	12	1	II	Aphakia	HM	HM	BSS	No	Yes	Graft failure	-
15	76	6	1	III	Pseudophakia	HM	0,016	BSS	Yes	Yes	-	-
16	75	12	5	III	Aphakia	HM	HM	BSS	No	Yes	Graft failure	-
17	38	6	1	II	Phakic	HM	HM	5000csSO	No	Yes	Graft failure	-
18	58	12	1	III	Pseudophakia	HM	HM	5000csSO	No	Yes	Graft failure	-
19	13	6	3	III	Aphakia	FC to 50cm	HM	5000csSO	Yes	No	Prephthisis	-
20	57	6	1	II	Pseudophakia	FC to 50cm	HM	5000csSO	Yes	No	PVR	PPV
21	7	6	24	I	Aphakia	HM	HM	5000csSO	Yes	Yes	-	-
22	37	6	48	III	Aphakia	HM	HM	5000csSO	Yes	No	PVR	PPV

No=Number, y=year,mo=months,HM=Hand motions, FC=Finger counting, NLP=No light perceptions, C3F8 = perfluoropropane, BSS = balanced salt solution, SO = siliconeoil, PVR=proliferative vitreoretinopathy,PPV=Pars plana vitrectomy

and in 3 patients (13.6%) vision increased and remained in 16 patients (72.7%). Alternative techniques have been used for posterior segment operations with corneal opacity. In a study by Chun et al. comparing TKP with endoscopic surgery, they concluded that the main difference observed between the two techniques was that endoscopy allowed earlier intervention and shorter surgical times than TKP, but with endoscopic retinal surgery probably patients needed a secondary corneal surgery.⁷ On the other hand, TKP with Landers provides a broad vision in operation.

The success rates of postoperative visual acuity of combined TKP / PPV / PKP surgery depends on patient selection. The severity of the problems is related to postoperative complications, which include corneal graft failure, phthisis bulbi, persistent hypotonia and recurrent proliferative vitreoretinopathy (PVR).^{3,7} Nowomiejska K. et al. has reported that, functional and anatomical outcomes are poor due to the severity of preoperative trauma in a series of 12 patients.⁸ The current study is in concordance with the literature; final visual acuities were as follows: 1 NLP eye, 18 HM eyes and 3 CF eyes, the best of which measured at 1 m. Functional blindness developed in 20 patients (<1/10) For all participants, BCVA increased only in 3 patients, unchanged in 16 patients and decreased in 3 patients.

Patients with trauma usually have retinal detachment and probably seen PVR. In a study by Ung C et al., which included 35 eyes with retinal detachment, 19 of them showed recurrence of retinal detachment due to PVR.⁹ In current study, all patients had a trauma history and at the last follow-up, retinal detachment recurred in 6 patients due to PVR. PPV was performed on patients who developed PVR.

Postoperative visual acuity was also affected by complications. In a study by Nowomiejska et al., the complication rates were reported as 75% corneal graft failure, 16% hypotonia due to ciliary body dysfunction and 16% glaucoma.⁸ In our study, graft failure (45.5%) and hypotonia (22%) were detected, while glaucoma was not seen in preoperative and postoperative controls. This could be because of preparing 0.5 mm larger corneal graft in our operations. In TKP operations, preparing 0.5 mm larger corneal graft decreases post-operative angle-closure glaucoma.^{10,11}

Opacification of the corneal graft is one of the causes of decreased visual acuity. Postoperative inflammation is a major cause of disruption of the transparency of the corneal graft. However, silicone oil and gases used as tamponade often adversely affect the transparency of the corneal graft.¹² In particular, it has been reported that silicone oil can cause endothelial loss of donor cornea and may result in decompensation.¹³ Huseyin and et al. reported a low

case number as a corneal graft decompensation after PPV with TKP. In our study, silicone tamponade was applied to 17 patients. Ten patients had an insufficient corneal graft at 6 months.¹⁰

Another source of reduced visual acuity is retinal detachment. Gelender H. et al.¹⁴ has reported that, retinal detachment was seen in 43% of the patients, compared to 27.2% in the current study.

The main limitation of our study its retrospective nature, on the other hand, there are some strengths like high case number for this operation and all operations done by the same surgeon.

In conclusion, in cases where vitreoretinal surgery is not possible due to corneal opacity, surgery can be performed with temporary keratoprosthesis in the same seans, and the damaged cornea can be permanently replaced by penetrating keratoplasty. Primary factors affecting the success of surgery are the degree of graft transparency, severity of initial trauma and the presence of retinal detachment. Also, 58.8% of patients that performed silicone oil in this operation underwent corneal decompensation. Probably further studies needed to decrease this rate.

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