



# Assessment of Visual Acuity after a year of penetrating Keratoplasty

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## A bstract

**Purpose:** To assess the best corrected visual acuity & post operative refractive errors after penetrating keratoplasty.  
 Study design: Case series.

**Methods:** This study included 45 patients undergoing penetrating keratoplasty for all indications of corneal blindness. Their pre-operative & post-operative best corrected visual acuity & post operative refractive errors were analyzed. All patients were operated by the same surgeon in Sardar Trust Eye Hospital, Garhi Shahoo & Institute of ophthalmology Mayo Hospital Lahore, Pakistan. The duration of follow-up was 1 year.

**Results:** The success rate of penetrating keratoplasty after 1- year follow up was 62%. Out of 45 patients, majority of patients (53%) had pre-operative VA between <3/60 to HM and rest of 38%, 2% & 7% patients had per-operative VA between PL, <6/60-3/60 & <6/18-6/60 respectively. Majority of patients (51%) have achieved post-operative uncorrected VA between <6/18 – 6/60. Out of 28 successful penetrating keratoplasty patients, 79% have achieved BCVA between 6/6 – 6/12 & 21% have between 6/18 – 6/60. Mean keratometric astigmatism was  $-4.45 \pm 2.32$  D & Mean cylindrical correction was  $-2.86 \pm 1.49$  D. Post-operative refractive errors were myopia (14%), hyperopia (4%), simple myopic astigmatism (7%), compound myopic astigmatism (21%) & mixed astigmatism (54%).

**Conclusions:** Successful restoration of visual acuity after Penetrating Keratoplasty depends upon pre-operative clinical factors like causes of corneal blindness, ocular surface problems, corneal vascularization and previous history of graft complication. Best Corrected VA achieved after Penetrating Keratoplasty ranged between 6/6-6/12 & majority of patient have Mixed Astigmatism.

**Key words:** penetrating keratoplasty, corneal blindness, corneal graft survival, refractive errors, Visual acuity.



## INTRODUCTION:

Diseases affecting the cornea are one of the major causes of blindness worldwide. The epidemiology of corneal blindness is complicated and encompasses a wide variety of infectious and inflammatory eye diseases that cause corneal scarring, which ultimately leads to functional blindness. In addition, the prevalence of corneal disease varies from country to country and even from one population to another.<sup>1</sup> Corneal blindness constitutes the major cause of visual impairment among the developing nations of the world. Before keratoplasty, corneal opacification was by and large untreatable. Corneal transplantation is currently one of the more effective ways to treat and cure many cases of corneal blindness with a high success rate.<sup>2</sup>

Eversince Edward Zirm reported the first successful allogenic penetrating keratoplasty in 1906, penetrating keratoplasty has become part of the standard repertoire of ophthalmic surgery in the treatment of corneal diseases.<sup>3</sup> Approximately 3300 penetrating keratoplasty are performed in United States each year.<sup>4</sup> Owing to recent developments in surgical techniques, materials, and postoperative management, indications for Penetrating Keratoplasty have been extended to high-risk patients with conditions such as corneal vascularization or re-grafting.<sup>5</sup>

The success rate of penetrating keratoplasties (overall graft survival at 5 year follow up) in the West is 66%,<sup>6</sup> whereas the survival rate at 1, 2, and 5 years in the developing countries for all corneal transplants performed are 79.6%, 68.7% and 46.5% respectively.<sup>7</sup>

The most common cause for graft failure in the re-graft subgroup was endothelial failure (41.8%).<sup>8</sup> The risk factors for graft failure after Penetrating Keratoplasty are corneal vascularization, re-graft, aphakia or pseudophakia, presence of anterior synechia, presence of posterior synechia, long operation time, and older recipient age. The risk factors after Penetrating Keratoplasty for allograft rejection are corneal vascularization, long operation time, and younger donor age. There is no association between graft failure or allograft rejection and graft size or suture technique.<sup>5</sup>

## Material and Methods:

Selected Patients who had undergone penetrating keratoplasty for all indications of corneal blindness were operated by the same surgeon and the duration of follow-up by the researcher was after 1 year. Clinical records of all (45) selected patients were taken from hospital (Sardar Trust Eye Hospital, & Institute of ophthalmology Mayo Hospital Lahore). The following data were obtained from each record: patient

demographics (age, gender), indications for surgery, preoperative assessment (visual acuity, Intraocular pressure, anterior segment, lens condition, posterior segment, B-scan, Lid margin anomalies, previous history of failure).

Postoperative assessment (graft clarity, graft complications, new eye disease, visual acuity, intraocular pressure, keratometer readings, anterior segment, lens condition, posterior segment) was done on the above mentioned patients. The patients with clear graft underwent refraction to get the best corrected visual acuity.

## Results:

The main indications of penetrating keratoplasty during this study in Pakistani patients were: Corneal Opacity (31%), Traumatic Corneal Opacity (11%), Repeat Penetrating Keratoplasty (11%), Keratoconus (11%) and Perforated Corneal Opacity (11%). Less common indications were: Bullous Keratopathy (7%), Macular Dystrophy (5%), Herpetic Corneal Opacity (5%), Adherent Leucoma (4%), Fuchs Endothelial Dystrophy (2%) and Corneal Degeneration (2%).

The bar graph in Fig. 1 represents that success rate of penetrating keratoplasty after 1- year follow up was 62% and the number of those patients who got complications was 38%. In Fig. 2 the pie chart shows that out of 45 patients, of performed penetrating keratoplasty, majority of patients (53%) had pre-op VA between <3/60 to HM and rest of 38%, 2% & 7% patients had per-op VA of PL, <6/60-3/60 & <6/18-6/60 respectively.

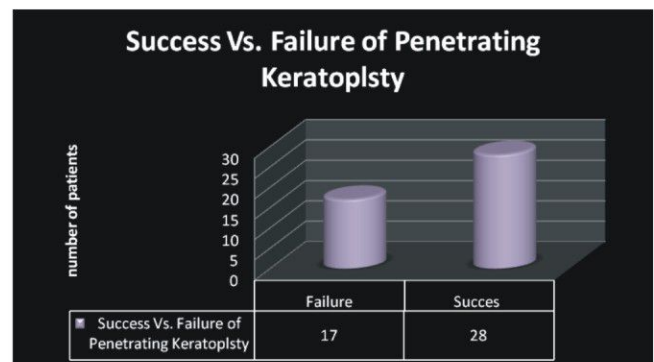


Fig 1: Success vs. Failure of Penetrating Keratoplasty after 1-Year Follow Up

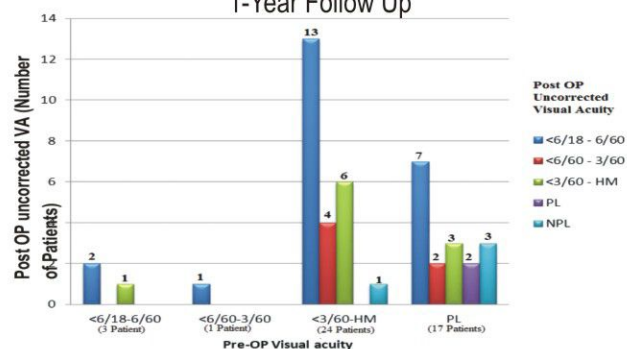


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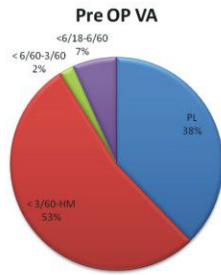


Fig. 2:Pre-Operative Visual Acuity

Fig. 3: Pre-Operative Visual Acuity Vs Post-Operative Uncorrected Visual Acuity at 1-year Follow Up

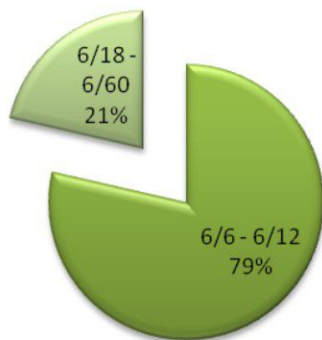
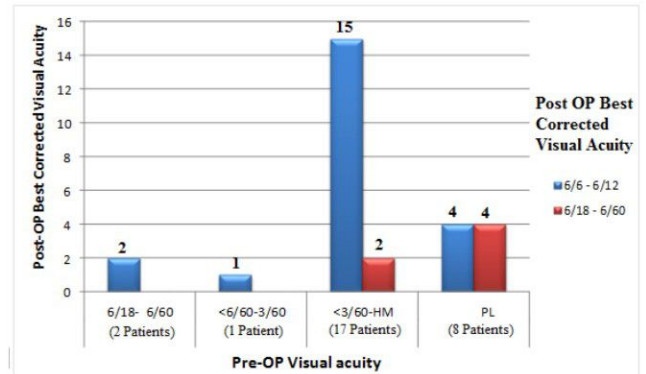


Fig. 3 shows that: Pre-OP PL -- 41%, 12% & 18% patients improved to post-op uncorrected VA between <6/18 - 6/60, <6/60 - 3/60 & <3/60 - HM respectively while 11% patient's post-op VA remain PL and 18% patient's post-op VA regress to NPL because of post-op complications. Pre-OP <3/60 - HM -- 54% & 17% patients improved to post-op uncorrected VA between <6/18 - 6/60 & <6/60 - 3/60 respectively while 25% patient's post-op VA remain <3/60 - HM and 4% patient's post-op VA regress to NPL because of post-op complications. Pre-OP <6/60 - 3/60 - 100% patients improved to post-op uncorrected VA between <6/18 - 6/60. Pre-OP <6/18 - <6/60 -- 67% patient's post-op uncorrected VA remain <6/60 - <6/18 and 33% patient's post-op VA regress to <3/60 - HM because of post-op complications. Out of 45, Maximum patients (51%) achieved post-op uncorrected VA between <6/18 - 6/60.

Fig. 4: Post-Operative Best Corrected Visual Acuity At 1-year Follow Up

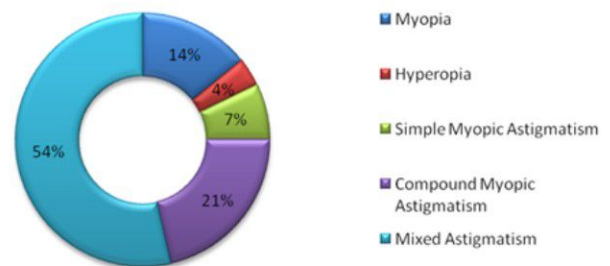
Fig. 4 explains that out of 28 successful Penetrating Keratoplasties patients 79% patients have achieved BCVA between 6/6 - 6/12 & 21% patients have achieved BCVA between 6/18 - 6/60. The patients had mean Keratometric astigmatism of  $-4.45 \pm 2.32$  D and mean cylindrical correction given to the 28 patients was of  $-2.86 \pm 1.49$  D.

Fig. 5: Pre-OP Visual acuity Vs Post-Operative Best Corrected Visual Acuity at 1-yr Follow Up



100% of them had achieved maximum post-op VA between 6/6 - 6/12. Significant improvement (P = .000) of Post-OP BCVA occurred after penetrating keratoplasty.

Fig. 6: Type of Post-Operative Refractive Errors 54% had Mixed Astigmatism and rest had compound myopic astigmatism, simple myopia, Simple myopic astigmatism &



Discussion:

In accordance with previous reports in the literature, the results of the present study suggest that visual outcome after penetrating keratoplasty and increase in visual acuity due to penetrating keratoplasty depends on several variables.<sup>3,6-8,9,10-</sup>

<sup>14</sup> One of the most important parameters was the reason why penetrating keratoplasty was performed.

In current study the survival rate was 62%. While survival rate was 79.6% in Indian<sup>7</sup> and 64.6% in USA<sup>13</sup> study after 1-year follow up. The difference in survival rate may be due to limited number of patients and compliance of patients to come for follow up, as I studied 45 patients while in above study 1725 and 79 patients were taken respectively.



In many of the developed and developing countries, Survival rate was highest if the corneal transplant was done for keratoconus.<sup>7,12,13</sup> Similar to this, in respective study success rate was highest for keratoconus (100%), Corneal dystrophies (100%) and corneal Opacity (71%). In USA study Final acuities achieved were: 47.5% 6/12 or better, 52.5% 6/15 to 6/60.<sup>13</sup> Out of 28 successful Penetrating Keratoplasties patients, in current study, 79% patients have achieved BCVA between 6/6 – 6/12 & 21% patients have achieved BCVA between 6/18 – 6/60 (P= .000) with spectacles. Full sutures of surgery have been removed majority of patients after 1year. Partial or no ROS of patients has been done either to control the patients corneal astigmatism or according to patients acceptance/adaptation to that astigmatism.

Concluding, the main predictive factors for visual outcomes after penetrating keratoplasty include the reason for keratoplasty, Pre-OP ocular surface problems, vascularity of cornea and previous history of graft. Hence the best results in patients with keratoconus, corneal dystrophies and corneal opacity & the worst results in patients with herpetic corneal opacity were observed. Meanwhile, Pre-OP ocular surface problems, vascularity of cornea and previous history of graft affect the graft survival rate and visual outcome to some extent. Post-OP abnormal IOP also initiate the rejection or failure in the healthy graft if it is not taken in to consideration. The astigmatism resulted after penetrating keratoplasty can be corrected by cylindrical correction, to meet the patient's acceptable level and with this correction the patients mostly became mixed astigmatic.

Reasonable success with corneal transplantation is possible in third world countries if data from these parts of world regarding the different survival rates for the various preoperative diagnosis and influence of risk factors on transplant survival and visual outcome are taken into account. This will also help the surgeon while determining priority for transplant cases in the present situation of limited availability of donor cornea.

In a nutshell, the penetrating keratoplasty is a high quality, beneficial surgical procedure and mean of rehabilitating the corneal blindness. Positive results for penetrating keratoplasty can be achieved. However like any other surgical procedure this also has incidence of post-operative complications but the ratio of these complications can be reduced by properly assessing the patient post-operatively at regular follow up.

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