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# A STUDY ON ENDOTHELIAL CELL LOSS AFTER OPTICAL KERATOPLASTY- A RETROSPECTIVE STUDY IN A TERTIARY EYE CARE CENTRE IN CHENNAI

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**ABSTRACT** **Aim:** a study of endothelial cell loss after optical keratoplasty in 50 patients in a tertiary care centre in Chennai. **Materials and Methods:** A retrospective study was carried out on 50 patients who underwent optical keratoplasty in a tertiary care centre in Chennai. 50 patients in the age group 11-80 were included in this study. Postoperatively they were periodically followed up regarding graft clarity, presence of vascularisation, vision and endothelial cell count. During follow up presence of any complications were assessed and recorded. **Observation And Results:** At the end of 6 months, there was an average of 37.5% loss of endothelial cells in PKP and 44.5% in LKPs and 38.6% in Triple procedure. At the end of one month, patients who had repeat Keratoplasty for failed graft had more loss (20.1%) whereas at the end of 6 months, Pseudophakic Bullous Keratopathy patients showed more loss (49.4%). These indicate migration of endothelial cells along a density gradient after keratoplasty. **Conclusion:** Overall there is continuous loss of endothelial cells in all cases of Keratoplasty regardless of the indication for keratoplasty and the type of keratoplasty. Even in cases of clear grafts, there is a continuous loss of endothelial cells. It has been reported that chronic subclinical rejection, chronic low-level inflammation or continued interaction between the donor endothelium and a healthy recipient endothelium could explain the greater cell loss.

**KEYWORDS :** Endothelial Cell Loss, Penetrating Keratoplasty, Lamellar Keratoplasty, Graft Rejection

## INTRODUCTION

Corneal transplants are performed to improve vision and increase the quality of life in patients with damaged or diseased corneas making this transplantation clinically and biologically significant. Corneal transplantation is also one of the most successful types of transplantation with failure rates at only 10 – 15% after one year and 30% after 5 years. The avascularity of the cornea makes it the only tissue capable of accepting homotransplants with minimum immunological reaction. Under certain conditions, because of poor immunologic interference, reactions of immunologic characteristics can occur. They are manifested in the form of cellular infiltration, vascularisation and necrosis of graft with partial or total rejection, subsequent opacification and functional failure of the procedure. Under normal conditions the adult human cornea loses endothelial cells at a rate of 0.6% per year. After intraocular surgery, the rate of cell loss is accelerated. This study aims to analyse the loss of endothelial cells after keratoplasty.

### Inclusion Criteria:

50 patients who underwent optical keratoplasty for keratoconus, pseudophakic bullous keratopathy, aphakic bullous keratopathy, corneal dystrophies, leucoma, failed graft were included in the study. Out of these 50 patients, 41 patients underwent penetrating keratoplasty. 4 patients underwent Lamellar keratoplasty and 5 patients underwent penetrating keratoplasty with cataract extraction and PCIOL implantation (Triple procedure).

### Exclusion Criteria:

Patients with dry eyes, detectable posterior segment lesions, associated glaucoma, active inflammation, systemic illness, irregular follow up were excluded from the study.

## MATERIALS AND METHODS

A retrospective study was carried out on 50 patients who underwent optical keratoplasty at the Cornea services of the Regional Institute of Ophthalmology and Government Ophthalmic Hospital, Egmore, Chennai. 50 patients who went optical keratoplasty with various indications were included in the study.

It included a detailed history taking and routine preoperative investigations for Keratoplasty. A detailed history was taken in every case. Slit lamp examination of the eye was done for the nature of the lesion, layers of cornea involved, type of pathology, presence of any vascularization, Synechiae, corneal sensation, state of the tear film and other abnormalities. Fundus examination was done with dilated pupils with direct and indirect ophthalmoscopes. In eyes with hazy media, B-scan was done to rule out posterior segment disorders. Vision with pinhole improvement recorded and Retinoscopy performed with dilated pupils. Intraocular pressure was recorded with Schiotz tonometer, corneal curvature measured with keratometer and corneal topography was done in all cases of Keratoconus. A clinical diagnosis was made and following investigations were done in every case , corneal staining -- to note whether the lesion is active or healed , Conjunctival smear – to rule out the presence of any pathogenic organisms, Schirmer's test – to rule out tear film abnormality, Patency of the duct – to rule out septic foci , Urine and blood examination – to rule out Diabetes mellitus, Blood pressure – to rule out Hypertension.

Table 1: Average Loss Of Endothelial Cells

| S. No. | | % of cells lost in 1m | % of cells lost in 6m |
|---|---|---|---|
| Indication for keratoplasty | | | |
| 1 | Pseudophakic bullous keratopathy | 13.4 | 49.4 |
| 2 | Corneal dystrophy | 5.6 | 23.6 |
| 3 | Aphakic bullous keratopathy | 9.7 | 37.0 |
| 4 | Keratoconus | 11.4 | 40.8 |
| 5 | Leucoma | 9.3 | 26.8 |
| 6 | Failed graft | 20.1 | 45.3 |
| Type of procedure | | | |
| 1 | PKP (41) | 10.6 | 37.5 |
| 2 | LKP (4) | 12.9 | 44.5 |
| 3 | Triple procedure (5) | 11.9 | 38.6 |

The corneal button was removed from the enucleated eye ball with 2mm of sclera around and was stored in MK medium until it was used for grafting. Before surgery study of the donor cornea was made to ascertain its suitability for grafting. All the patients received either A or B+ grade of donor cornea.

Local anaesthesia was used in 48 patients and 2 patients needed general anaesthesia. The size of the donor material was selected depending upon the recipient size. 7.5mm of donor material was trephined and placed over 7mm of recipient bed in 49 cases. In one case, 8mm graft was placed over 7.5mm recipient bed. In all cases 4 interrupted sutures and continuous sutures were applied with 10-0 monofilament nylon. Lamellar keratoplasty was done in 4 cases. Simultaneous cataract extraction and PCIOL implantation was done in

5 cases. At the end of the operation, subconjunctival dexamethasone was given to all patients. The eyes were pad and bandaged after instilling antibiotic eyedrops. Intraoperative complications if any were recorded and treated. Post operatively the patients received topical antibiotics, steroids, tear substitutes and systemic steroids. The state of the grafted eye was evaluated daily and any complications observed during the postoperative period were recorded and treated appropriately. The operated eye was examined under slit lamp. Graft clarity, presence of vascularization, status of suture and condition of anterior chamber was noted. The patients were subjected to visual acuity testing and specular microscopic examination to study the endothelial count. Follow up was done every week up to four weeks, every two weeks up to three months and every month thereafter. During follow up, the vision of the operated eye, clarity of the graft, endothelial count and presence of any complications were assessed and recorded.

## OBSERVATION AND RESULTS

20 % of the patients who underwent keratoplasty were in age group from 61 to 70 years. 66% were male patients and 34% were female patients. 66% were males and 34% were females. Pseudophakic bullous keratopathy was the commonest indication for keratoplasty. It accounted for 28% of cases. Pre-operative visual acuity was less than 3/60 in all the patients in the operated eye. 46% of the patients had preoperative visual acuity of counting fingers at 1 to 3 meters.

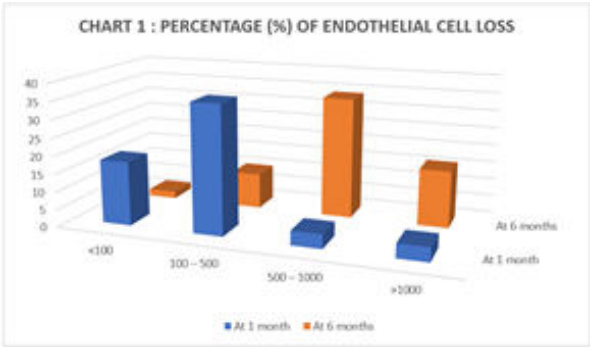
Pre-operative visual acuity was less than 3/60 in all the patients in the operated eye. 46% of the patients had preoperative visual acuity of counting fingers at 1 to 3 meters. “A” grade eye was used in 64% of patients and “B+” grade eye was used in 36% of patients. 41 (82%) patients had Penetrating keratoplasty, 4(8%) patients had Lamellar keratoplasty and 5(10%) patients underwent Triple procedure. Majority of the patients (92%) had uneventful surgery without any complications. 8 patients (16%) had primary graft failure and 4 patients (8%) had Graft rejection at the end of 6 months. 2 patients (4%) had persistent epithelial defect; 3 patients (6%) had astigmatism of more than 6D. Primary graft failure was more common in patients who underwent keratoplasty for aphakic bullous keratopathy. At the end of 6months, 37 patients (74%) had transparent graft and 9 patients (18%) had opaque graft. Out of 50 patients, 15 had good vision, 18 had moderate vision, 15 did not improve and 2 patients had poor vision. Visual results were good in Keratoconus and Corneal dystrophy patients. At the end of 1m, 54% of patients showed endothelial cell loss of less than 500.At the end of 6m POP, 50% of the patients showed endothelial cell loss of more than 500 cells. At the end of 1m, an average of 20.1% cells was lost in case of keratoplasties done for failed graft. Only 5.6% of cells were lost in case of corneal dystrophies. At the end of 6 months, 49.4% of cells were lost in case of pseudophakic bullous keratopathy. Only 23.6% of cells were lost in case of corneal dystrophy. Loss of endothelial cells was more in case of LKP (44.5%) and triple procedure (38.6%) at the end of 6m post-operative period.

**Table 2: Visual Outcomes In Different Corneal Lesions**

| S. No. | Corneal Lesions | Good (6/36 – 6/9) | % | Moderate (3/60 – 6/60) | % | Poor (PL – 3/60) | % |
|---|---|---|---|---|---|---|---|
| 1 | PBK (14) | 3 | 21.4 | 5 | 35.7 | 6 | 42.8 |
| 2 | ABK (7) | 2 | 28.5 | - | - | 5 | 71.4 |
| 3 | Corneal dystrophy (6) | 4 | 66.6 | - | - | 2 | 33.3 |
| 4 | Keratoconus (7) | 6 | 85.7 | 1 | 14.2 | - | - |
| 5 | Leucoma (10) | 3 | 30.0 | 4 | 40.0 | 3 | 30.0 |
| 6 | Failed graft (6) | 2 | 33.3 | 3 | 50.0 | 1 | 16.6 |

## DISCUSSION AND RESULTS

In this study, pseudophakic bullous keratopathy was found to be the commonest indication which required keratoplasty. It accounted for 28% of cases, and the next being corneal opacity accounting for 20% of cases. Most of the cases belonged to the age group between 41 – 70 years. Lowest age limit in which corneal grafting done was 12 years and the highest age was 74 years. Preoperative visual acuity in 19(38%) patients was counting fingers at 1 meter to 3 meter and in 14(24%) patients it was only HM+. 41(82%) patients underwent PKP, 4(8%) patients underwent LKP and 5(10%) patients underwent Triple procedure. Out of 50 patients, 28(56%) patients had no complications at the end of 6m. 4(8%) patients had graft rejection. 3(6%) patients had astigmatism of more than 6D. 8(16%) patients had primary graft failure. Primary graft failure was more frequently associated with aphakic bullous keratopathy patients. On studying the post-operative endothelial cell count in these patients, in 29(58%) patients the endothelial count could not be assessed during immediate post-operative period due to mild graft edema (Table 1). At 1m post op, it was not possible in 14(28%) cases and at 6m post op, it was not possible in 18(36%) cases. Overall, there was continuous loss of endothelial cells in all cases regardless of the indication for keratoplasty and the type of keratoplasty. Visual outcomes for different indications were varied in nature (Table 2). Percentage of endothelial cell loss at end of 1month and 6 months are as depicted in Chart 1.




Graft size and recipient factors such as indications, glaucoma, and glaucoma surgery are all highly associated with the occurrence of endothelial decompensation[1]. Jeffrey J et al[2] reported that chronic subclinical rejection, chronic low-level inflammation or some other interaction between the donor endothelium and a healthy recipient endothelium could explain the greater cell loss. In previous publications, cumulative rates of endothelial cell loss after PK were reported as 31–45% at the first year[2,3,4] 33% at the second year[5], 54% at the third year[6].Sato confirmed a considerable endothelial cell loss following successful keratoplasty. He concluded that cell loss was the result of surgical trauma and postoperative inflammation and suggested that recovery took place largely by expansion of the surviving cells. At 1month post op, there was an average of 10.6% loss of endothelial cells in PKP patients. This was 12.9% in LKP and 11.9% in Triple procedure. At the end of 6m there was an average of 37.5% loss of endothelial cells in PKP. This was 44.5% in LKP and 38.6% in Triple procedure. At the end of 1m, patients who had repeat keratoplasty for failed graft had more loss (20.1%) whereas at the end of 6m, pseudophakic bullous keratopathy patients showed more loss (49.4%). This is comparable to the study done by Bertelmann E, Pleyer U, and Rieck P[6] where the lowest rate of endothelial cell loss was associated with patients diagnosed with keratoconus. Patients with DALK had a lesser endothelial cell loss compared to the PKP group as seen in study by Ku BI et al [7]. Langenbucher A et al[8] reported that endothelial cell loss seems to be least pronounced after Penetrating keratoplasty in keratoconus (2.9%), followed by Fuch's dystrophy (11.2%) and Bullous keratopathy (19.3%). Patel et al[9] found that endothelial cell loss at 15 years appeared lower in the grafts transplanted for aphakic corneal edema than in those transplanted for keratoconus, Fuchs' dystrophy, or pseudophakic corneal edema, when compared with preoperative. Graft rejection was lowest for the keratoconus group[10] and thus the high endothelial cell loss for grafts in keratoconus patients could be explained by classic graft rejection These differences between diagnoses indicate migration of endothelial cells along a density gradient after keratoplasty.

## CONCLUSION

The success of corneal grafting in visual rehabilitation of the corneal blind depends on survival of the grafts. Graft survival after keratoplasty is determined to a large extent by the course of endothelial cell loss. Overall, there is continuous loss of endothelial cells in all cases of keratoplasty regardless of the indication for keratoplasty and the type of keratoplasty. Even in cases of clear grafts, there is a continuous loss of endothelial cells. It has been reported that chronic subclinical rejection, chronic low-level inflammation or continuous interaction between the donor endothelium and a healthy recipient endothelium could explain the greater cell loss. Graft failure was significantly associated with grafts done for Aphakic bullous keratopathy or for regrafts. Surface problems, increased intraocular pressure and infection are other complications that are more likely to cause graft failure in certain categories of patients. Hence, one can never underestimate the need for meticulous surgery in corneal grafting. The surgeon should have high index of suspicion for sub clinical rejections and post-operative inflammation and knowledge

about these associations can be helpful in looking for and aggressively treating these conditions. This can possibly reduce the chance of graft failure and rejection.

**Limitations of the study:**

The study design being retrospective in nature was a limitation by itself. Lamellar keratoplasty was less commonly performed at the center during the study period hence could not be done in large numbers.

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