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A STUDY OF POST-OPERATIVE ASTIGMATISM AND VISUAL OUTCOME IN PATIENTS OPERATED FOR PENETRATING KERATOPLASTY AND DEEP ANTERIOR LAMELLAR KERATOPLASTY

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ABSTRACT

Background: Penetrating keratoplasty performed for corneal disorders is associated with several complications resulting in visual impairment.

Lamellar transplant often shows better visual outcome as compared to penetrating keratoplasty (PKP). Deep anterior lamellar keratoplasty (DALK) is currently considered to be the first choice operative procedure in patients with corneal disease not involving endothelial layer.

The objective of present study is to compare the results of DALK with those of PKP in eyes with the similar pre-operative conditions.

Materials and methodology: This prospective analytical study was conducted in ophthalmology department at tertiary care hospital for a period of 2 years. 30 patients with heterogenous corneal pathologies were operated for either DALK or PKP. A detail history taking and pre-operative evaluation was done. Post-operative follow-up was done at 1,3 and 6 months and examined for BCVA, refraction and complications in both the groups.

Conclusion: In younger patients requiring keratoplasty for optical indications, lamellar keratoplasty is a better procedure compared to penetrating keratoplasty in preserving patient's endothelium and reducing astigmatism

KEYWORDS : penetrating keratoplasty, lamellar keratoplasty, astigmatism

INTRODUCTION

- Keratoplasty has evolved by leaps and bounds since its inception.
- During 1970s and early 1980s, penetrating keratoplasty was performed for various corneal disorders, but it had many intra-operative and post-operative complications.
- To overcome such problems, concept of lamellar keratoplasty was evolved. The basic principle of it is to replace only the diseased part of cornea and leave recipients normal anatomic layers intact. It is most useful for treatment of corneal disease in setting of normally functioning endothelium thus eliminating possible complications of endothelial graft rejection [1-3]
- Anterior lamellar keratoplasty is a surgical procedure in which a maximum of diseased cornea is replaced by donor tissue. Commonly the anterior stroma is incised by trephine that can be a set to a depth not exceeding the corneal thickness and several stromal layers dissected until the desired depth of recipient bed is obtained. However there is a risk of interface haze and scarring with lamellar dissection. Less scarring can occur if lamellar dissection is performed at a deeper level i.e. Deep anterior lamellar keratoplasty.
- However, lamellar dissection is difficult to perform at a deeper level as stromal dissection depth relative to corneal thickness cannot be optically visualized. Therefore it bears the inadvertent risk of perforation. It can become more feasible and less complicated procedure, if stromal dissection can be made at visually controlled depth, which is possible with Melles technique, big bubble technique, double bubble technique.
- Removal of the damaged corneal stroma can be achieved by manual dissection with surgical blade and scissors, microkeratome- assisted lamellar cut, or femtosecond laser-assisted cut. Descemet's membrane detachment from the corneal stroma can be performed using air injection (big-bubble technique), hydrodelineation through a sclerocorneal flap, or sodium hyaluronate injection. [4-6]
- In this study, we reviewed patients on whom PKP and DALK was performed for various corneal pathologies and assessed their post-operative outcome on serial follow-up.

• METHODOLOGY

This prospective analytical study is conducted on 30 patients. A prior consent was taken from Institutional Ethics Committee. A detailed history and complete ophthalmic examination was done. A series of investigations was done and accordingly chosen for either DALK or PKP.

- **INCLUSION CRITERIA:**
- Patients who presented with corneal opacities, dystrophies, degeneration, deep scarring who had BCVA of less than 6/60(=1.0 in log MAR) and not improving beyond it and gave consent.

EXCLUSION CRITERIA:

- Patients who denied consent
- Patients who had glaucoma and posterior segment pathology
- Patients with tectonic indications

- Pre-operative examination of the recipient was done. Presence of any predisposing factors, past history of ocular surgeries, any other existing pathologies of ocular adnexa were ruled out. A prior consent was taken.
- Clinical examination of the recipient included uncorrected visual acuity, best corrected visual acuity (BCVA) using logMAR distance visual acuity chart and Snellen's reduced near vision. Cycloplegic refraction was done using Heinz streak retinoscope. Thorough ocular examination was carried out with slit lamp biomicroscopy and all findings recorded. Tonometry was done using Schiotz or non-contact tonometer.
- Detailed fundus examination to rule out any posterior segment pathology and Sac syringing was done.
- BP measurement and all routine blood investigations were done. Ultrasonography (B-scan) was done if fundus not visible.
- Keratoplasty was performed following the ethical guidelines for biomedical research on human subjects issued by the Indian council of medical research.
- Enucleation of both the eyes was done in less than 5 hours from the donor. All the eyes used in the study were stored in MK media and used in less than 72 hours in all patients. Grading of donor cornea was done according to the endothelial cell count (done on specular microscope). Preferably corneas of young donor with good endothelial cell count were used.
- Pre-operative preparation included oral antibiotics and antibiotic drops. Also IOP lowering drugs in the form of oral acetazolamide and injection mannitol was given before surgery. 2%pilocarpine drops were instilled in all cases to maintain intra-operative miosis.
- All patients who underwent either DALK or PKP were entered into longitudinal study.

Post-operative protocol:

Eye is patched till there is no epithelial defect. Once it is healed, topical antibiotic and steroids are started which are gradually tapered. Anti-glaucoma and cycloplegic medication is also given for about a month.

- **Follow-up:**

The patients were evaluated on first day, first week and then on 1st,3rd and 6th month post-operatively.

Clinical examinations were done on each follow-up.

1. Uncorrected visual acuity
2. Best corrected visual acuity (recorded using log MAR distance visual acuity and Snellens near vision chart)
3. Slit lamp examination was done to evaluate tear film status, graft clarity, interface (in DALK), sutures, residual graft edema, anterior chamber reaction or iritis. Any complications like double anterior chamber, interface haze, graft haze, graft rejections if present were managed accordingly.
4. IOP assessment
5. Corneal topography done in last follow-up.

The observations were recorded and charted for analysis.

RESULTS AND DISCUSSION

- The data is expressed as Mean ± SD. The statistical analysis is performed using independent t-test.

Age distribution:

Age group (years)	No of cases		Percentage of cases	
	DALK	PKP	DALK	PKP
10-20	03	00	10%	00%
20-30	04	03	13.33%	10%
30-40	05	03	16.67%	10%
40-50	03	02	10%	6.66%
50-60	02	05	6.67%	16.67%
Total	17	13	56.67%	43.33%

- Total number of male patients operated for DALK and PKP is 30% and 26.67% respectively and female patients are 26.67 and 16.67% respectively.
- The mean age of patients in this study is 37.4±12.56 years with maximum age being 59 years and minimum age being 16 years.

Indications of DALK and PKP

Indications	No of patients		Percentage	
	DALK	PKP	DALK	PKP
Corneal opacity	11	8	36.67%	26.67%
Corneal dystrophy	5	0	16.67%	0.05%
Corneal degenerations	1	5	3.33%	16.67%

Most common indication for DALK and PKP was corneal opacity followed by corneal degenerations.

- According to the grading of corneal vascularization, there were 14 avascular cornea in DALK group and 11 in PKP. There were 3 patients with low risk corneal vascularization operated for DALK and 2 for PKP. More than 2 quadrant vascularization with associated lymphatics is an important risk factor for graft rejection. [7]
- Size of graft plays a very important role in the success of keratoplasty as observed from this study. There was 1 donor graft of <7mm in PKP and 1 graft in each group were 8 mm. The discrepancy between the recipient size to the donor graft size is 0.5mm in all the grafted tissue. Problem with graft size disparity is of astigmatism. On one side, large graft provides advantage of additional quantity of endothelium and on another side it increases risk of graft rejection and disparity produces astigmatism.
- Distribution of BCVA during each follow-up (DALK)

Visual acuity (logMAR)	Pre-op patients	Post-op patients			
		1 week	1 month	3 months	6 months
2.01-3.00	3	0	0	0	0
1.01-2.00	13	8	3	2	1
0.60-1.00	1	9	12	12	8
0.40-0.59	0	0	2	3	3
0.20-0.39	0	0	0	0	4

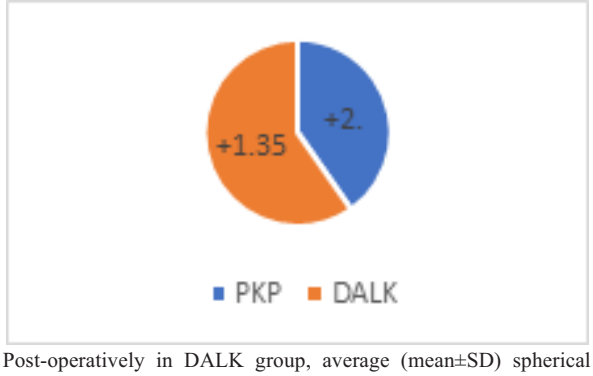
- **Distribution of BCVA during each follow-up (PKP)**

Visual acuity (logMAR)	Pre-op patients	Post-op patients			
		1 week	1 month	3 months	6 months
2.01-3.00	3	0	0	0	0
1.01-2.00	9	8	3	2	1
0.60-1.00	1	5	9	5	4
0.40-0.59	0	0	1	6	5
0.20-0.39	0	0	0	0	1

- The above tables states that majority of patients had their pre-operative visual acuity within ranges of 1.01-2.00 which contributes for 13 cases in DALK and 9 in PKP. 2 patients had their pre-operative visual acuity within range of 0.60-1.00, one on each group. 3 patients in each group had their pre-operative visual acuity within range 2.01-3.00. The mean (±2SD) pre-operative visual acuity (logMAR) in this study is 1.967±1.112 in DALK and 2.076±1.164 in PKP.
- Post-operatively at the end of 1 week, majority of patients had their visual acuity within range of 1.01-2.00 in PKP group and within range of 0.621 in DALK group which contributes for 8 and 9 cases respectively. None of the patients had their vision better than 0.40 at the end of 1 week. The mean (±2SD) post-operative visual acuity in (logMAR) at 1 week is 1.117±0.948 for DALK and for PKP 1.369±0.886.
- Post-operatively at the end of 1 month, majority of patients had their visual acuity within range of 0.60-1.00, which contributes for 12 cases of DALK and 9 cases of PKP. There were 3 cases with visual acuity in range of 1.01-2.00 and 2 cases of DALK and 1 case of PKP in range of 0.40-0.59. No patients had vision within range of 0.20-0.39. The mean (±2SD) post-operative visual acuity in (logMAR) at 1 month is 0.882±0.558 for DALK and 0.984±0.962 for PKP.
- Post-operatively at the end of 6 months, there were 8 cases of DALK and 4 of PKP with visual acuity in range of 0.6-1.00. There were 3 cases of DALK and 5 of PKP with visual acuity in range of 0.40-0.59. There were 4 cases of DALK and 1 of PKP with visual acuity in range of 0.20-0.39. The mean (±2SD) post-operative visual acuity (logMAR) at 6 months is 0.668±0.608 for DALK and 0.569±0.730 for PKP.
- Independent t-test was applied to the statistics of BCVA at 6 months between both the groups. There is t- value of 0.766 with 'p' value of 0.452 which is >0.05, so there is no significant difference between BCVA at 6 months between DALK and PKP group.

- **Spherical refractive outcome at 6 months:**

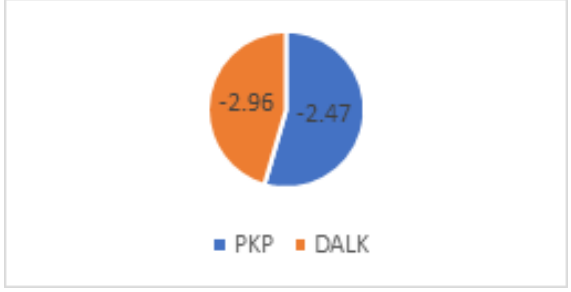
Duration	Spherical refractive (D) (Mean±2SD)	
6 months	DALK	PKP
	+1.35±(1.55)	+2±(1.34)



Post-operatively in DALK group, average (mean±SD) spherical refractive error at 6 months was +1.35±(1.55)D and in PKP was +2±(1.34)D

- **Cylindrical refractive outcome at 6 months:**

Duration	Cylindrical error (D)(Mean±2SD)	
6 months	DALK	PKP
	-2.47±(1.14)	-2.96±(1.47)



Post-operatively in DALK group, average (Mean±SD) cylindrical refractive error at 6 month was -2.47±(1.14)D and in PKP it was -2.96±(1.47)D

Complications

Post-op complications	No of patients		Percentage	
	DALK	PKP	DALK	PKP
DM tear	2	0	11.76	00
Graft haze	3	1	17.64	7.69
Graft rejection	1	3	5.88	23.07
Graft injection	0	1	00	7.69

From the above data, it can be stated that in DALK group, there is more DM tear and graft haze than PKP. While there is more graft rejection in PKP.

Incidence of various intra-operative and post-operative complications correlates well with this study.

CONCLUSION

- The study includes 30 cases of heterogenous corneal pathologies that were operated with DALK and PKP.
- Conditions in which the pathology is limited to anterior stroma and sparing the endothelium, lamellar keratoplasty offers advantaged with fewer risk of complications.
- In younger patients requiring keratoplasty for optical indications, DALK is better as it preserves patient's own functional endothelium. Donor quality is not a limiting factor in DALK and hence there is effective utilization of the available donor tissue.

The following important conclusions can be derived from the study:

1) After both the procedures, there is significant improvement in post-operative visual acuity (measured in log MAR) at each follow-up when compared with pre-operative visual acuity.
2) Both procedures have problem of post-operative astigmatism
3) In DALK, the major limiting factors affecting visual outcome are graft host interface haze and irregular astigmatism
4) DALK procedure is associated with less incidence of immunological graft rejection compared to penetrating keratoplasty as recipient's endothelium is not sacrificed in this procedure.

REFERENCES:

1) Shimmura S, Tsubota K. Deep anterior lamellar keratoplasty. Curr Opin Ophthalmol 2006;17:349-55
2) Kawashima M, Kawakita T, Den S, et al. Comparison of deep lamellar keratoplasty and penetrating keratoplasty for lattice and macular corneal dystrophies. Am J Ophthalmol 2006;142: 304-9
3) Krumeich JH, Knulle A, Krumeich BM. Deep anterior lamellar(DALK) vs PKP; a clinical and statistical analysis (in German). Klin Monbl Augenheilkd 2008;225:637-48
4) Anwar M, Teichmann KD, Big bubble technique to bare Descemet's membrane in anterior lamellar keratoplasty. J cataract Refract Surg 2002;28:398-403
5) Senoo T, Chiba K, Terada O, et al. Deep lamellar keratoplasty by deep parenchyma detachment from the corneal limbs. Br J Ophthalmol 2005;89: 1597-600
6) Shimmura S, Shimazaki J, Omoto M, et al. Deep lamellar keratoplasty in keratoconus patients using viscoadaptive viscoelastics. Cornea 2005;24:178-81
7) Herminder S. Dua, Augusto Azura and Blaco: corneal allograft rejection; Risk factor, Diagnosis, prevention and treatment. IJO 1999;147