

Penetrating keratoplasty: indications, outcomes and complications

Pankaj Vitthal Shaha

¹Assistant Professor, Department of Ophthalmology, Dr. Ulhas Patil Medical College and Hospital, Jalgaon, Maharashtra, INDIA.
Email: pramod.bhirud@yahoo.com

Abstract

Corneal transplantation is a surgical procedure where a damaged or diseased cornea is replaced by donated corneal tissue. The indications for Penetrating keratoplasty includes: Optical (to improve visual acuity by replacing the opaque host tissue by a healthy donor or pseudophakic bullous keratopathy) and Tectonic (in patients with stromal thinning and descemetocoeles, to preserves corneal anatomy and integrity). Keratoplasty is one of the ocular surgeries that contribute with the reinsertion to job and daily activities and quality life of patients. For these reason, it is very important to study the complications and how to protect cornea before and after keratoplasty for visual health and integrity of the eye and to prevent it.

Key Words: Penetrating keratoplasty.

*Address for Correspondence:

Dr. Pankaj Vitthal Shaha, Assistant Professor, Department of Ophthalmology, Dr. Ulhas Patil Medical College and Hospital, Jalgaon, Maharashtra, INDIA.

Email: pramod.bhirud@yahoo.com

Received Date: 10/07/2017 Revised Date: 09/08/2017 Accepted Date: 16/09/2017

DOI: <https://doi.org/10.26611/10093310>

Access this article online

Quick Response Code:	Website: www.medpulse.in
	Accessed Date: 21 September 2017

INTRODUCTION

Corneal transplantation, also known as corneal grafting, is a surgical procedure where a damaged or diseased cornea is replaced by donated corneal tissue (the graft). When the entire cornea is replaced it is known as penetrating keratoplasty and when only part of the cornea is replaced it is known as lamellar keratoplasty.¹ Keratoplasty simply means surgery to the cornea. The graft is taken from a recently dead individual with no known diseases or other factors that may affect the chance of survival of the donated tissue or the health of the recipient. The cornea is a window of transparent tissue at the front of the eyeball. It allows light to pass into the eye and provides focus so that images can be seen. Various diseases or injury can make the cornea

either cloudy or out of shape. This prevents the normal passage of light and affects vision. A cloudy cornea can be replaced by a healthy one from a donor to restore vision.² Keratoplasty is the medical term that refers to a cornea transplant. There are some differences between the definitions of keratoplasty, commonly it is mentioned for corneal transplant, Lamellar Keratoplasty, which is a partial thickness corneal grafting and penetrating keratoplasty is a full-thickness corneal grafting.^{2,3} The indications for Penetrating keratoplasty includes:⁵

1. Optical (to improve visual acuity by replacing the opaque host tissue by a healthy donor or pseudophakic bullous keratopathy)
2. Tectonic (in patients with stromal thinning and descemetocoeles, to preserves corneal anatomy and integrity)
3. Therapeutic (removal of inflamed corneal tissue refractive to treatment by antibiotics or antiviral drugs)
4. Cosmetic (in patients with corneal scars giving a whitish opaque hue to the cornea)

The most frequent causes of corneal alterations leading to keratoplasty are⁴

- Keratoconus
- Bacterial infections
- Poor hygienic contact lens wear

Some side effects of keratoplasty can be infection (keratitis on the new transplanted cornea or endophthalmitis), transplant rejection, vision fluctuation, glaucoma and bleeding, among others less reported. Infection is one of the most frequent complications after keratoplasty, which can cause endophthalmitis. Infection after keratoplasty, can result from inappropriate healing or like a complication during the transplant. Among microbial infections, bacterial infections are the most frequent and are mainly caused by *Staphylococcus* sp., *Streptococcus* sp. or *Pseudomona* sp.⁵

Complications of Penetrating keratoplasty^{6,7,8}:

Transplant rejection is one of the hardest complications after keratoplasty. It occurs when the body rejects the new cornea. But it can occur from days to several years after surgery. Symptoms that show that the immunological system has rejected the cornea may be redness of the eye, an extreme sensitivity to light and pain, autoimmune diseases, infiltrates and also unknown causes. Signs of rejection may occur anywhere from one month to several years after the transplant surgery. There is glaucoma like a potential complication after keratoplasty. Glaucoma is a buildup of pressure in the eye that can cause a complete loss of vision. Keratoplasty increases the chances of pressure buildup during the surgical procedure that may lead to glaucoma for metabolism changes on the stroma or perhaps can be caused for immunological reactions or metabolic associations.⁹ Additionally, may appear bleeding and pain after keratoplasty, sometimes the blood vessels may leak, which would result in bleeding from the eyes. In these cases, sitting upright will encourage the blood to settle. Pain after the keratoplasty is a common side effect oftentimes due to dry eyes. In theory the dry eye contribute with corneal infection, probably due to the opportunistic microbes, which invade the tissue, also is the same with the use of contact lenses for long periods due to hypoxia (low oxygen) and to hypercapny (increase of carbon dioxide CO₂). Patients usually feel pain and discomfort when they move the eye at all for weeks after surgery.¹⁰ Ocular infection occurs mostly in immunosuppressed patients, prior diabetes mellitus, hypertension, hypoadrenalism, taking oral corticosteroids, atopic dermatitis; prolonged use and low hygienic conditions with contact lenses (soft lenses are more frequent than RGP contact lenses), opportunistic microorganisms which interfered with normal flora, dry eye and a low percentage for contamination of the surgical team.

The etiology of keratoplasty in cases of microbial infection has been reported by several authors, as well as the findings on postoperative keratoplasty, one of the main causes is keratoconus and previous corneal graft

rejection.¹¹ The most common microbiological findings correspond to bacteria such as *Staphylococcus* sp., *Pseudomonas* sp., *Pneumococcus* sp. *Serratiamarcescens*, *Streptococcus pneumoniae*, *Streptococcus viridians*, *Bacillus* sp., *Corynebacterium* sp. primarily and other microorganisms such as fungi (*Candida* sp. *Candida glabrata*, *Aspergillus* sp., *Fusarium* sp.), among the viruses that are mostly found associated with keratoplasty are the herpes simple.¹² The most microbial reported associated with microbial keratitis which required keratoplasty are bacterial associations (Driebe and Stern 1983) following by mycotic and herpetic infections and less often, *Acanthamoeba* sp. The complications are more dangerous if there is an association with corneal stroma because the cornea needs respiration (Hill, 1976). Despite of microbiological and immunological complications are significant to prevent rejection. Those are relationship with the age of the receptor. The allograft rejection has been reported more common in children than in adults, possibly due to a more active immune system in younger patients. On those patients the pediatric transplant sometimes not without clear evidence of endothelial rejection. The rejection may even many years after transplantation. Glaucoma is another common complication on these patients; also ocular hypertension can damage the optic nerve and threaten the survival of the graft and therefore the visual prognosis. Other complications, including endophthalmitis, choroidal hemorrhage, cataract, retinal detachment and phthisis bulbi are relatively rare but do occur.¹³ In the case of penetrating keratoplasty, the secondary astigmatism post penetrate keratoplasty (PK) is another complication to consider when using this technique. The first factors that may influence the refractive outcome is PK preexisting pathology in the recipient cornea, such as keratoconus, trauma and other causes of thinning or irregularity, especially peripheral, and therefore persist in the transplanted cornea. Additionally, systemic diseases such as diabetes, collagen disease, recipient age, may also affect healing. During surgery, there are other parameters to take into account to prevent complications: compression or deformation of the globe, ocular tone down a narrow cleft interpalpebral a misplaced speculum, a thread tension of the upper rectum or scleral support ring misplaced which can distort the cornea during the trephination and cause a receiver window oval or distorted.⁷

CONCLUSION

- 'Keratoplasty' is one of the ocular surgeries that contribute with the reinsertion to job and daily activities and quality life of patients.

- For these reason, it is very important to study the complications and how to protect cornea before and after keratoplasty for visual health and integrity of the eye and to prevent it.
- **Graft failure:** Early: Cloudiness of the cornea from the first post-op day. It is usually caused by defective donor endothelium or trauma during surgery. Late: Usually the result of immune graft rejection. 50 % occur in the first 6 months, and the majority occurs in the first year post-operative.⁶
- It is equally important to know the history of allergies, systemic diseases and associations that can bring further complications in the recipient and ideally have the donor immunologic and systemic associations to verify their biocompatibility and immunological affinities between donor and receptor of the cornea.

Benefits of penetrating keratoplasty

- **Improved vision:** Approximately 75% of transplant recipients have vision sufficient to drive legally but, may need glasses or contact lenses or sometimes further surgery for best results.
- It may take up to 18 months until the full improvement in vision is appreciated.

Few **restrictions** recommended by American Ophthalmology Association about postsurgical care to prevent procedure failures:^{6,10}

1. Use metal shield nightly or when taking a nap during the day and a cloth pad under glasses during the waking day, for 1 month.
2. Not bend at the waist for more than 10 minutes at a time, but may squat at the knees.
3. Not lift or push anything heavier than 15 pounds, including grandchildren, for 2 weeks.
4. Hair may be gently shampooed by a friend or a beauty shop with the head leaning slightly backwards for 2 weeks.
5. May watch TV
6. No heavy exercise of any kind for 3 weeks
7. No sexual intercourse for 3 days after surgery.
8. No swimming for 3 weeks.

9. Not read for more than 10 minutes at a time for 2 weeks.
10. Walking is permitted.

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Source of Support: None Declared
Conflict of Interest: None Declared