Postoperative detection of unusual pathology in donor corneal tissue

Louis J Stevenson[1], Graeme Pollock[2], Rasik B Vajpayee[1,3]

We present a series of three patients with previously undetected corneal pathology in grafted corneal tissue following keratoplasty for keratoconus. Postoperatively, a faint layer of anterior stromal haze involving the graft was observed in each patient upon slit lamp examination. Anterior segment optical coherence tomography (AS-OCT) confirmed the presence of anterior stromal scarring across the transplanted cornea. However, the ocular and systemic medical histories of the donors were unremarkable. As the suboptimal donor corneal tissue may escape the standard screening protocols, eye banks should consider adding AS-OCT imaging for screening donor corneal tissue before transplantation.

Key words: Corneal imaging, corneal transplantation, donor cornea, eye banking, optical coherence tomography

A healthy donor corneal tissue is mandatory for successful keratoplasty. Thus, robust screening protocols are followed to reduce the risk of grafting diseased or flawed tissues. These include detailed scrutiny of donors' medical histories, thorough slit lamp examination of donated tissue and donor risk assessment interviews with those persons who knew the donor well. However, these processes at times can be lacking and donors who have previously undergone laser refractive surgery have in the past, escaped detection.[1] We report a series of three cases in which unexplained anterior stromal scars were detected postoperatively in donor corneal tissues.

Case Reports

Three illustrative cases involving patients whose donor grafts were found to have anterior stromal scarring following uncomplicated corneal transplantation surgery were identified in the outpatient clinics.

In all cases, corneal tissue was obtained from donors in Melbourne, Australia. Following standard consent, tissue was retrieved as corneoscleral rims, with screening and preparation performed at the Lions Eye Donation Service, Melbourne, Australia. The standards and guidelines of the Eye Bank Association of Australia and New Zealand[2] and the Therapeutic Goods Administration of Australia[3,4] were employed and followed. Donor history was obtained from hospital medical records and from medical records of the donor family physician. Further history was obtained from a knowledgeable historian during a donor risk assessment interview, which included explicit questions regarding previous ocular surgery, pathology, refractive procedures, or therapies. All corneoscleral discs underwent routine screening, which included *in situ* penlight examination, slit lamp biomicroscopy examination of the excised corneoscleral disc, specular microscopy of the endothelium, placement into organ culture preservation media with repeat microbiological testing, and light microscopy examination at the end of the storage period. Reported demographic and clinical data were taken from clinic and eye bank medical records.

Case 1

A 40-year-old male presented with a history of advanced keratoconus affecting his right eye. His right and left best corrected visual acuities (BCVA) were 20/200 (6/60) and 20/20 (6/6), respectively. A predescemetic deep anterior lamellar keratoplasty (DALK), using a Dia-DALK technique,[5] was successfully performed in his right eye. At one week postoperatively, a well-defined anterior stromal scar was detected in the grafted cornea. This finding was confirmed by anterior segment optical coherence tomography (AS-OCT) [Fig. 1].

No history of corneal surgery, pathology, or infection was identified on initial screening of the donor. The donor age was 24 yrs and tissue was PK grade with Endothelial Cell density of 3383 cells/mm^2. The patient was informed of this unusual postoperative finding and following lengthy discussion, a graft exchange was successfully performed. The abnormal graft tissue was sent for histopathologic examination which revealed dense hypocellular fibrosis with hyaline change, associated with embedded shaft-like foreign bodies. At 12-months following graft exchange surgery, the patient's right BCVA was 20/30 (6/9).

Case 2

A 25-year-old female underwent an attempted big bubble DALK to treat keratoconus in her left eye. Intraoperatively, an unsalvageable perforation occurred and the procedure was converted to a penetrating keratoplasty (PK). At the 6-week postoperative follow-up, a well-defined anterior stromal scar was detected in the donor cornea upon slit lamp examination [Fig. 2a], which was subsequently confirmed by anterior segment OCT (AS-OCT) [Fig. 2b]. As the patient's left

Access this article online

Quick Response Code:

Website: www.ijo.in

DOI: 10.4103/ijo.IJO_728_19

[1]Corneal Unit, Royal Victorian Eye and Ear Hospital, East Melbourne, [2]Centre for Eye Research Australia, East Melbourne, [3]Vision Eye Institute, Melbourne, Victoria, Australia

Correspondence to: Prof. Rasik B Vajpayee, Royal Victorian Eye and Ear Hospital, University of Melbourne, 32 Gisborne Street, East Melbourne - 3002, Victoria, Australia. E-mail: rasikv@unimelb.edu.au

Received: 14-Apr-2019 Revision: 29-May-2019
Accepted: 14-Jun-2019 Published: 22-Oct-2019

Cite this article as: Stevenson LJ, Pollock G, Vajpayee RB. Postoperative detection of unusual pathology in donor corneal tissue. Indian J Ophthalmol 2019;67:1889-91.

BCVA was 6/9, the decision was made to manage conservatively and observe. Initial screening of the donor, including a donor risk assessment interview, did not reveal any significant findings nor did a review of the donor's medical history. The endothelial cell density of donor cornea was 3200 cells/mm^2 and was PK Grade tissue with donor age being 21 yrs.

Case 3

A 30-year-old male, presented with advanced keratoconus in his left eye. His right and left BCVA were 20/30 (6/9) and 20/200 (6/60), respectively. A successful Dia-DALK[5] was performed in his left eye and both the surgery and postoperative course were unremarkable. A diffuse anterior stromal haze was noted within the graft at the four-week follow-up, which was further characterized by AS-OCT, revealing a well-defined anterior stromal scar extending across the donor cornea [Fig. 3]. The patient was informed of this finding and the decision was made to manage conservatively and monitor the lesion due to the patient's excellent visual acuity which was 20/40 (6/12). At 1 year, the patient's left BCVA was 20/20 (6/6). Neither the initial screening of the donor, including the donor risk assessment interview, nor did a review of the donor's medical history reveal any significant findings. The donor was 50 years old and the corneal tissue had an endothelial density of 2985 cells/mm^2.

Discussion

There are many reports in the literature of unhealthy donor tissue escaping the screening processes of eye banks,[1,6] indicating that the current screening protocols practiced by many eye banks may not be able to detect pathologies such corneal scars or previous corneal laser refractive surgery scars.

Subtle corneal pathologies may be difficult to detect in donor tissue due to the development of stromal edema and epithelial degradation prior to tissue collection. The challenges faced by eye banks in screening donor tissues for difficult-to-detect pathologies, such as a previous laser-assisted *in situ* keratomileusis (LASIK) surgery, have been highlighted.[7] In comparison to histological examination, when screened on history or slit lamp examination alone, the rate of misidentification of previous LASIK surgery in donor tissue was found to be 13.5% and 18.2%, respectively. Even when donor tissue was screened using a combination of history and slit lamp examination, the rate of misidentification was still 3.4%. It is significant then that in all the cases we report here, that no ophthalmic history was identified in the donor, including when direct and specific questions were asked of the knowledgeable historians on previous eye surgery, refractive procedures, or vision correcting procedures.

Given these difficulties, screening methods must be refined to decrease the risk of transplanting suboptimal donor tissue and implementing the use of OCT may be of benefit in enhancing the screening process. A laboratory-based study has demonstrated the ability of OCT to consistently detect the flap-stromal interface following LASIK surgery.[8]

OCT has also been found to detect a range of stromal opacities.[9] Bald *et al*. examined seven corneas, found to have anterior stromal opacities on slit lamp examination, with OCT.[9] Significantly, this resulted in the diagnoses of two cases being revised. The first involved a cornea in which a presumed stromal opacity was found to be localized to the epithelium, while the second involved a cornea in which a presumed epithelial opacity was found to be localized to the stroma.

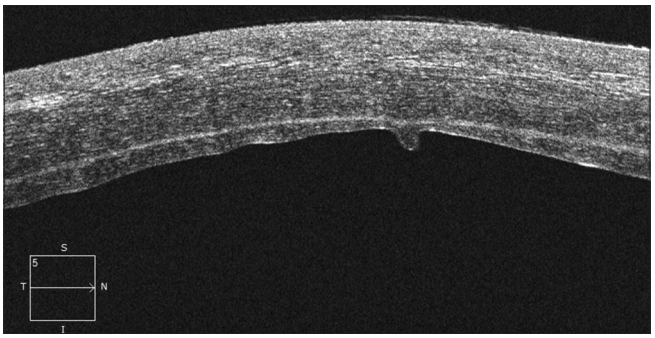

Figure 1: Anterior segment optical coherence tomography demonstrating a well-defined anterior stromal scar in donor graft

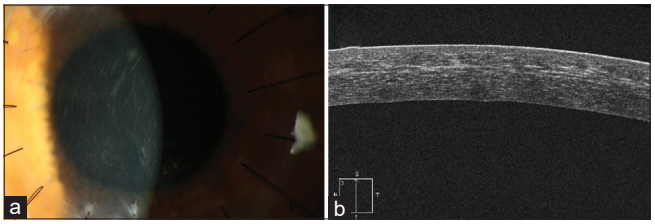

Figure 2: (a) Slit lamp photography demonstrating stromal corneal haze. (b) The same lesion demonstrated on anterior segment optical coherence tomography

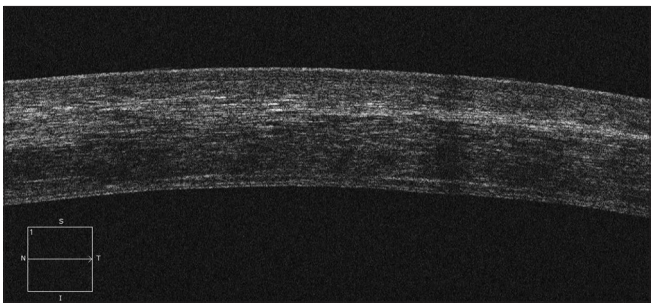

Figure 3: Anterior segment optical coherence tomography demonstrating an anterior stromal opacity

In conclusion, anterior stromal corneal pathologies may remain undetected by current eye bank screening protocols that do not use corneal OCT. Therefore, it is recommended to incorporate AS-OCT imaging of donor corneal tissue into routine eye bank screening procedures to minimize the risk of suboptimal tissue being accepted for transplantation.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Michaeli-Cohen A, Lambert AC, Coloma F, Rootman DS. Two cases of a penetrating keratoplasty with tissue from a donor who had undergone LASIK surgery. Cornea 2002;21:111-3.
2. Eye Bank Association of Australia and New Zealand. EBAANZ Medical and Quality Standards for Eye Donation and Eye Tissue Banking [EBAANZ web site]. April, 2009. Available from: http://ebaanz.rasidesigns.com/wp-content/uploads/2015/06/EBAANZMedicalQualityStandards2nd EditionApril2009.pdf. [Last accessed on 2019 Mar 28].
3. Australian Government. Therapeutic Goods Order No. 88 - Standards for donor selection, testing and minimising infectious disease transmission via therapeutic goods that are human blood and blood components, human tissues and human cellular therapy products [Federal Register of Legislation web site]. May 20, 2013. Available from: https://www.legislation.gov.au/Details/F2013L00854. [Last accessed on 2019 Mar 28].
4. Australian Government. Therapeutic Goods Order No. 85-Standards for Human Ocular Tissue [Federal Register of Legislation web site]. July 8, 2011. Available from: https://www.legislation.gov.au/Details/F2011L01491. [Last accessed on 2019 Mar 28].
5. Vajpayee R, Maharana P, Sharma N. Diamond knife assisted deep anterior lamellar keratoplasty (Dia-DALK): A new surgical technique for management of keratoconus. Invest Ophthalmol Vis Sci 2013;54:1750.
6. Angulo EM. Accidental grafting of a donor cornea with radial keratotomy in a keratoconus patient. J Refract Surg 1989;5:198.
7. Kang SJ, Schmack I, Edelhauser HF, Grossniklaus HE. Donor corneas misidentified with prior laser *in situ* keratomileusis. Cornea 2010;29:670-3.
8. Priglinger SG, Neubauer AS, May CA, Alge CS, Wolf AH, Mueller A, *et al*. Optical coherence tomography for the detection of laser *in situ* keratomileusis in donor corneas. Cornea 2003;22:46-50.
9. Bald MR, Stoeger C, Galloway J, Tang M, Holiman J, Huang D. Use of fourier-domain optical coherence tomography to evaluate anterior stromal opacities in donor corneas. J Ophthalmol 2013;2013:397680.