JOJ
Ophthalmology

Research Article
Volume 1 Issue 1 - August 2015

JOJ Ophthal

Stromal Rejection after Deep Anterior Lamellar Keratoplasty (DALK) - A Retrospective Study

Vipul Bhandari*

Sankara Eye Hospital, India

Submission: August 27, 2015; Published: September 05, 2015

***Corresponding author:** Vipul Bhandari, Sankara Eye Hospital, Coimbatore, India, Tel: 9901815342; Email: drvipulbhandari@gmail.com

Abstract

Aim: To report and analyse the incidence of stromal rejction, which is a central island of flattening of the graft associated with thinning in patients who underwent DALK for keratoconus.

Materials & Methods: Retrospective review of patients who underwent DALK for progressive keratoconus from 2010 to 2013 was done. Patients who completed 2 years of follow up were included. Slit lamp findings, corneal topography and central corneal thickness were analysed.122 eyes of 71 patients were analysed. Uncorrected visual acuity (UCVA) and best corrected visual acuity (BCVA) were analysed in each visit

Results: Thirty one eyes of thirty one patients showed topographic evidence of Central Island of flattening which correlated with slit lamp finding of stromal haze of varying density. The pachymetry reading of the central cornea varied from 400 to 479µ and correlated with topographic finding of flattening. The average onset of central stromal haze was at 9 months post DALK. None of the patients had bilateral involvement. The central haze progressed over time and was associated with thinning of the cornea. The onset and progression of central flattening was associated with corresponding decrease in UCVA and BCVA. No epithelial defect was noted.

Conclusion: 25.4% of keratoconus patients who underwent DALK developed a central island of flattening with associated decrease in the visual acuity. The central haze, flattening and thinning may be a chronic stromal rejection or progressive thinning of cornea associated with disease process of keratoconus.

Keywords: Keratoconus; DALK; Stromal rejection

Key Messages: Stromal rejection after DALK.

Abbrevations: UCVA: Uncorrected Visual Acuity; BCVA: Best Corrected Visual Acuity; PK: Penetrating Keratoplasty; DALK: Deep Anterior Lamellar Keratoplasty; CCT: Corneal Pachymetry

Introduction

Keratoconus is a degenerative, non-inflammatory corneal disorder characterized by progressive stromal thinning and ectasia.10-20% of keratoconus patients requires surgical intervention in advanced stage in the form of either Penetrating Keratoplasty (PK) or Deep Anterior Lamellar Keratoplasty [1]. Deep Anterior Lamellar Keratoplasty (DALK) is preferred over PK due to less incidence of graft failure [2]. Visual outcome of DALK surgery is comparable to PK, avoiding risk of endothelial rejection. Endothelial cell loss was low and cell count was stable after 6 months [3]. Watson et al. [4] compared DALK with PK. Best corrected visual acuity, refractive results and complication rates are similar after DALK and PK. Compared to PK, one of the major advantages of DALK is normal endothelial cell counts postoperatively. Comparatively DALK has endothelial cell loss of 1.2% at 2 years. Cell survival after DALK may be expected to be better than PK [5]. In spite of refractive stability obtained during the first years after PK for keratoconus, increasing astigmatism thereafter suggests that there is a progression of the disease in the host cornea [6]. Recurrent keratoconus following PK is rare but has been described [7-8]. N Patel has reported the first case of recurrent ectasia in a relatively new treatment option-deep lamellar keratoplasty for keratoconus [9]. We in our study have analysed post DALK patients for any such changes after two year of follow up.

Material and Methods

Retrospective analysis 122 eyes of 71 patients who underwent DALK for progressive keratoconus. Inclusion criteria were patients who underwent DALK for keratoconus from 2011 to 2013 and those who completed 2 years of follow-up after obtaining approval from institutional review board and ethical

committee clearance. Exclusion criteria included all patients who had any intra or post operative complications. Keratoconus was diagnosed clinically based on slit lamp findings (stromal thinning, Fleischer ring, Vogt's striae) and keratometry, and was confirmed by corneal topography and Pentacam. Preoperative evaluations included uncorrected visual acuity (UCVA), best corrected visual acuity (BCVA), slit lamp biomicroscopy, corneal topography (Keratonscout), corneal pachymetry (CCT) (AL-2000; Tomey) .None of the patients had previous history of refractive surgery. DALK was done in all patients using Anwar a Teichmann big-bubble technique [11]. All donor cornea had an endothelial count greater than 2000 cells and clear stroma. All grafts were well centered with an average graft size of 8-8.5mm and done by a single surgeon. The donor cornea was fixed with interrupted 10–0 nylon sutures in all the patients. Patients received Dexoren-S (dexamethasone sodium phosphate 0.1% and chloramphenicol 0.5%, warren excel, INDOCO) e/d 6 times per day for 1 month followed by 4 times per day for 1 months then changed to Lotepred 0.5%(Loteprednoletabonate ophthalmic suspension, SUNpharma) e/d 4 times per day for 2 months followed by 2 times for 1 month followed by 1 time for 6 months. Follow-up examinations were scheduled 1, 7 and 30 days and 3,6,9,12 and 24 months postoperatively and complete suture removal was done after 6-18 months thereafter based on topography and automated keratometry readings. Parameters analyzed were UCVA, BCVA, Slit lamp findings, corneal topography, CCT and stromal haze.

Clinical grading of stromal haze–

Grade 0-completelty clear cornea

Grade 0.5 for trace haze seen with careful oblique illumination with slit lamp biomicroscopy.

Grade 1 for more prominent haze not interfering with visibility of fine iris details.

Grade 2 for mild obscuration of iris details.

Grade 3 for moderate obscuration of iris details.

Grade 4 for complete opacification of stroma.

Statistical Analysis

Significance was assessed at 5 % level of significance. Paired t-test was used to compare pre- and postoperative astigmatism and BSCVA values and Chi-square test was used for comparison of qualitative parameters

Results

A total of 122 eyes of 71 patients with progressive keratoconus were operated. Mean age at the time of surgery was 26.2±7.8 (range 15-40) years. 31 eyes of 25 patients (25% of total) showed topographic evidence of Central Island of flattening. It correlated with slit lamp finding of sub epithelial haze of varying density. The average onset of central sub epithelial haze was at 9-12 months post DALK (Figure 1). Haze was more common in the younger age below 25 years with 60% cases with stromal haze below 25 years of age, no sex association was noted. None of the patients had bilateral involvement. The central haze progressed over

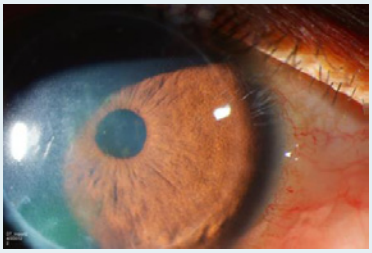

Figure 1: Showing onset of haze at 9-12 months after DALK.

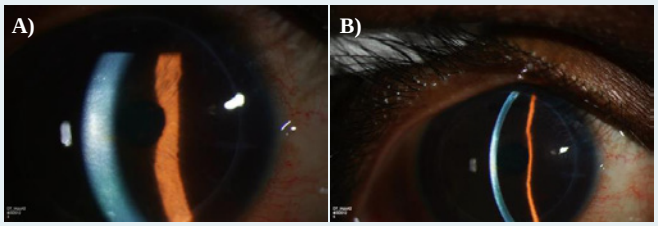

Figure 2: Showing progression of central haze.

time (Figure 2a & 2b) and was associated with thinning of the cornea. These 31 eyes with stromal rejection (study group) were compared with other eyes (91 eyes) with absence of thinning or haze (control group). Mean UCVA was 0.7±0.3LogMAR in control group while in study group it was 0.88±0.15LogMAR (P<0.005). Mean BSCVA in control group was 0.19±0.18LogMAR while in study group it was 0.62±0.11LogMAR (P<0.001). The onset and progression of central flattening was associated with corresponding decrease in UCVA and BCVA. Mean keratometry in study group was K flat 40.81±1.41D and K steep 44.12±1.45 D while in control group it was K flat 45.38±2.72 D and K steep 44.12±1.45 D. Mean pachymetry reading in study group was 443.481±.45µm while in control group it was 535±16.45µm. The pachymetry reading of the central cornea varied from 400µ to 475µm and correlated with topographic finding of flattening (Figure 3a & 3b) (Table 1). Pentacam images also showed central flattening (Figure 4a & 4b). Anterior segment OCT also showed stromal haze at periodic follow up (Figure 5a & 5b). No graft surface complications were encountered.

Discussion

Mohammad Ali Javadi et al. [11] listed the causes of decreased vision after DALK. Which includednon-endothelial graft rejection, astigmatism filamentary keratitis, vascularization. Recurrence of keratoconus in a donor cornea has already been described [12-14]. and may well be manifestation of the same mechanisms that caused ectasia of the host cornea in the first place. This could be due to degradative enzymes liberated by abnormal host epithelium or infiltration of the graft by abnormal host keratocytes that produce abnormal collagen [15-16]. One speculative mechanism is failure to completely excise the cone before PKP which may lead to progression of keratoconus in the host tissue with possible involvement of the dono [17-18]. Feizi S et al. [19] reported a case of recurrence of keratoconus in corneal graft after DALK. Till now no study has shown the flattening of graft with stromal haze in late post operative period. In our study,

How to cite this article: Bhandari V. Stromal Rejection after Deep Anterior Lamellar Keratoplasty (DALK) - a Retrospective Study. JOJ Ophthal. 2015;1(1): 555551.

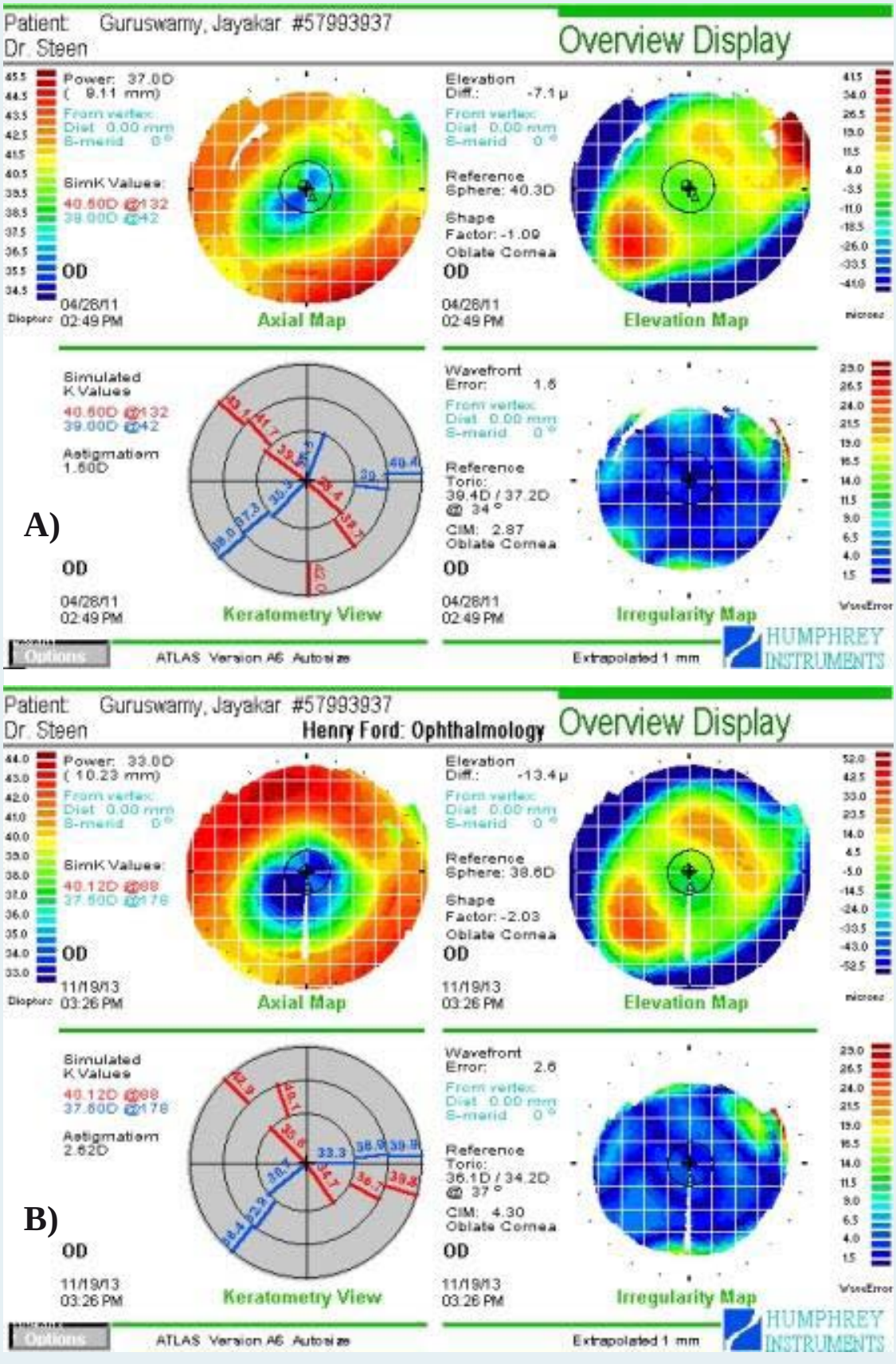

Figure 3: Topography showing central flattening.

How to cite this article: Bhandari V. Stromal Rejection after Deep Anterior Lamellar Keratoplasty (DALK) - a Retrospective Study. JOJ Ophthal. 2015;1(1): 555551.

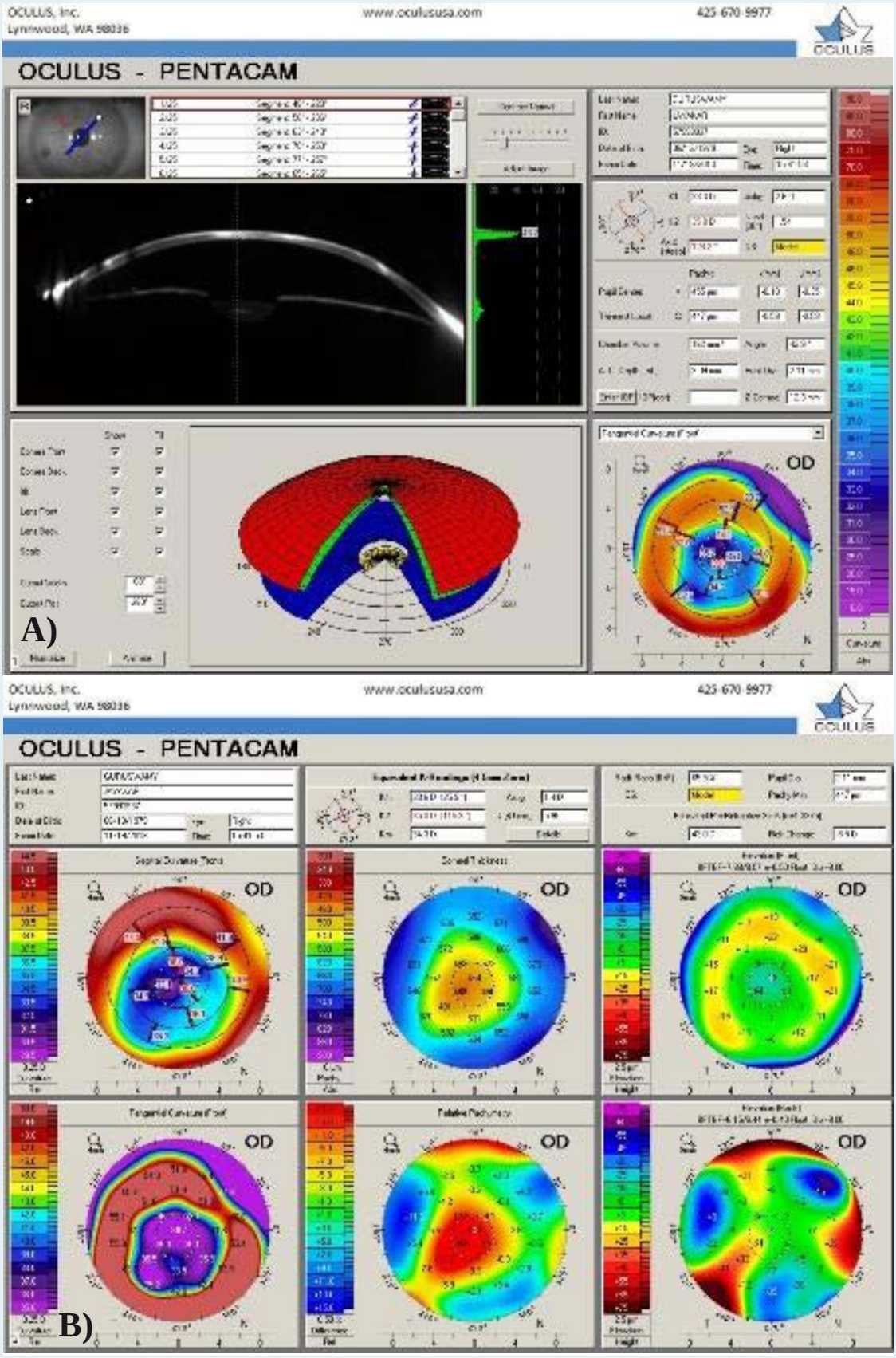

Figure 4: Pentacam showing area of central flattening.

How to cite this article: Bhandari V. Stromal Rejection after Deep Anterior Lamellar Keratoplasty (DALK) - a Retrospective Study. JOJ Ophthal. 2015;1(1): 555551.

	Control (n=91)	Study (n=31)	P value
Haze	0.00	1.71+/-0.64	<0.001
K flat (D)	45.38+/-2.72	40.81+/-1.41	<0.001
K STEEP (D)	45.55=/-2.84	44.12+/-1.45	<0.005
UCVA (Log MAR)	0.7+/-0.33	0.88+/-0.15	<0.005
BCVA (Log MAR)	0.19+/-0.18	0.62+/-0.11	<0.001
Pachymetry	535+/-16.45	443.48+/-13.58	<0.001

Table 1: Showing various parameters in control and study groups.

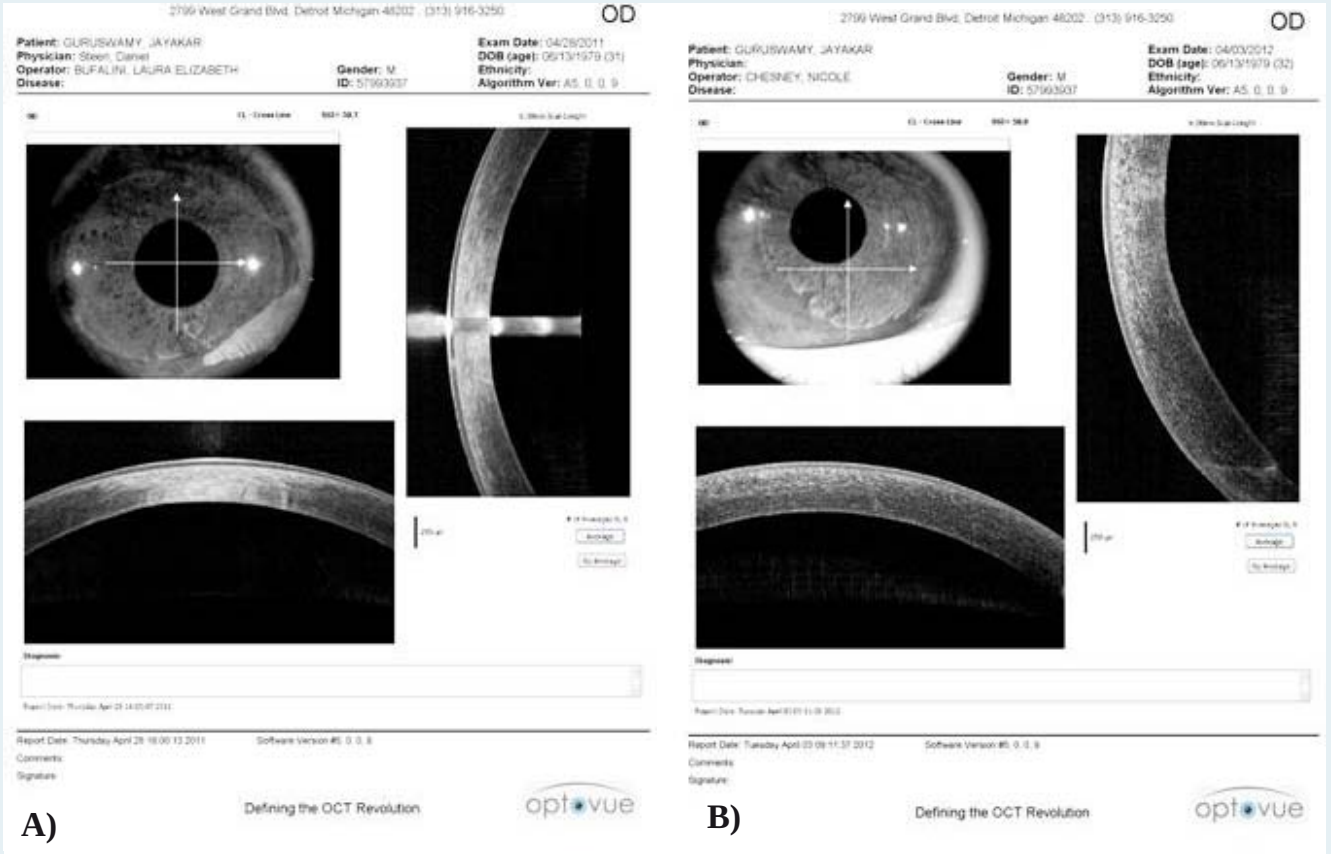

Figure 5: AS-OCT showing progressive increase in the haze.

inverse keratoconus was recorded in eyes after 2 years after deep lamellar keratoplasty and this was confirmed both clinically and topographically. Stromal rejection i.e, central haze, flattening and thinning in the graft after DALK for keratoconus (Figure 4 & 5) may be chronic stromal rejection or progressive thinning of cornea associated with disease process of keratoconus or due to reduced corneal sensations. In contrast to PK, keratoconus recurred a few years after DALK. Such earlier recurrence can be attributed to several differences pertaining to the DALK surgical technique. First, retained keratocytes in the stromal bed may invade and replace donor tissue leading to recurrent keratoconus much earlier than what is expected in PK. We previously reported that even after successful big-bubble formation, some posterior stroma containing abnormal keratocytes remains in place [20]. Second, removal of DM from the donor cornea, a common practice in DALK, can theoretically weaken donor tissue. Although our comparison of graft biomechanical properties between bare-DM DALK and PK in keratoconic eyes failed to demonstrate a significant difference [21]. DM removal may actually yield donor tissue with less strength resulting in earlier manifestation of ectasia when keratoconus recurs in the DALK graft. The inflammatory pathways activated following DALK failure due to infection, in particular the metalloproteinase system (gelatinolytic activity of stromal collagenase (matrix metalloproteinase-1 (MMP-1)), may play an important part through thinning of the stromal tissue [22].

Conclusion

In our study the pathogenesis of corneal haze, flattening and thinning complication was unclear. Donor factors include the

How to cite this article: Bhandari V. Stromal Rejection after Deep Anterior Lamellar Keratoplasty (DALK) - a Retrospective Study. JOJ Ophthal. 2015;1(1): 555551.

possibility of ectatic disease which may have been missed or remained subclinical throughout the donor's life. New screening methods utilising the Orb scan are being explored looking at the topography of donor corneas that could prevent potential problems with using ectatic corneas if routinely employed [23]. In summary, a central island of flattening after DALK with associated decrease in the visual acuity can be a chronic stromal rejection or progressive disease process of keratoconus for which we need to further investigate.

References

1. Rabinowitz YS (1998) Keratoconus. Surv Ophthalmol 42(4): 297-319.
2. Reinhart WJ, Musch DC, Jacobs DS, Lee WB, Kaufman SC, et al. (2011) Deep anterior lamellar keratoplasty as an alternative to penetrating keratoplasty a report by the american academy of ophthalmology. Ophthalmology 118(1): 209-218.
3. Sarnicola V, Toro P, Gentile D, Hannush SB (2010) Descemetic DALK and predescemetic DALK: Outcomes in 236 cases of keratoconus. Cornea 29(1): 53-59.
4. Watson SL, Ramsay A, Dart JK, Bunce C, Craig E (2004) Comparison of deep lamellar keratoplasty and penetrating keratoplasty in patients with keratoconus. Ophthalmology 111(9): 1676-1682.
5. Van Dooren BT, Mulder PG, Nieuwendaal CP, Beekhuis WH, Melles GR (2004) Endothelial cell density after deep anterior lamellar keratoplasty (Melles technique). Am J Ophthalmol 137(3): 397-400.
6. de Toledo JA, de la Paz MF, Barraquer RI, BarraquerJ (2003) Long-term progression of astigmatism after penetrating keratoplasty for keratoconus: evidence of late recurrence. Cornea 22(4): 317-323.
7. Becharkis N, Blom ML, Stark WJ, Green WR (1994) Recurrent keratoconus. Cornea 13(1): 73-77.
8. Kremer I, Eagle RC, Rapuano CJ, Laibson PR (1995) Histologic evidence of keratoconus seven years after keratoplasty. Am J Ophthalmol 119(4): 511-512.
9. Patel N, Mearza A, Rostron CK, Chow J (2003) Corneal ectasia following deep lamellar keratoplasty. Br J Ophthalmol 87(6): 799-800.
10. Anwar M, Teichmann KD (2002) Big-bubble technique to bare Descemet's membrane in anterior lamellar keratoplasty. J Cataract Refract Surg 28(3): 398-403.
11. Javadi MA, Feizi S, Jamali H, Mirbabaee FC (2009) Deep anterior lamellar keratoplasty using the big-bubble technique in keratoconus. J Ophthalmic Vis Res 4(1): 8-13.
12. Abelson MB, Collin HB, Gillette TE, Dohlman CH (1980) Recurrent keratoconus after keratoplasty. Am J Ophthalmol 90(5): 672-676.
13. Kremer I, Eagle RC, Rapuano CJ, Laibson PR (1995) Histologic evidence of recurrent keratoconus seven years after keratoplasty. Am J Ophthalmol 119(4): 511-512.
14. Pramanik S, Musch DC, Sutphin JE, Farjo AA (2006) Extended long-term outcomes of penetrating keratoplasty for keratoconus. Ophthalmology 113(9): 1633-1638.
15. Teng CC (1965) Electron microscope study of the pathology of keratoconus: I. Am J Ophthalmol 55: 18-47.
16. Cannon DJ, Foster CS (1978) Collagen crosslinking in keratoconus. Invest Ophthalmol Vis Sci 17(1): 63-65.
17. Ilari L, Daya SM (2003) Corneal wedge resection to treat progressive keratoconus in the host cornea after penetrating keratoplasty. J Cataract Refract Surg 29(2): 395-401.
18. Bechrakis N, Blom ML, Stark WJ, Green WR (1994) Recurrent keratoconus. Cornea 13(1): 73-77.
19. Feizi S, Javadi MA, Rezaei Kanavi M (2012) Recurrent keratoconus in a corneal graft after deep anterior lamellar keratoplasty. J Ophthalmic Vis Res 7(4): 328-331.
20. Jafarinasab MR, Rahmati-Kamel M, Kanavi MR, Feizi S (2010) Dissection plane in deep anterior lamellar keratoplasty using the big-bubble technique. Cornea 29(4): 388-391.
21. Jafarinasab MR, Feizi S, Javadi MA, Hashemloo A (2011) Graft biomechanical properties after penetrating keratoplasty versus deep anterior lamellar keratoplasty. Curr Eye Res 36(5): 417-421.
22. Fitton JH, Ziegelaar BW, Hicks CR, Clayton AB, Crawford GJ, et al. (1998) Assessment of anticollagenase treatments after insertion of a keratoprosthetic material in the rabbit cornea. Cornea 17(1): 108-114.
23. Terry MA, Ousley PJ (1999) New screening methods for donor eye-bank eyes. Cornea 18(4): 430-436.

How to cite this article: Bhandari V. Stromal Rejection after Deep Anterior Lamellar Keratoplasty (DALK) - a Retrospective Study. JOJ Ophthal. 2015;1(1): 555551.