

Deep anterior lamellar keratoplasty for the management of iatrogenic keratectasia occurring after hexagonal keratotomy

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Iatrogenic keratectasia has been reported subsequent to refractive surgery or trauma. Hexagonal keratotomy (HK) is a surgical incisional technique to correct hyperopia. A number of complications have been reported following this procedure, including irregular astigmatism, wound healing abnormalities and corneal ectasia. When visual acuity is poor because of ectasia or irregular astigmatism and contact lens fitting is not possible, penetrating or lamellar keratoplasty can be performed. Since incisions in refractive keratotomy are set at 90–95% depth of cornea, intraoperative microperforations are known to occur and lamellar keratoplasty may become difficult. We describe deep anterior lamellar keratoplasty (DALK) used to successfully manage keratectasia after HK. Pre DALK vision was 20/400 and post DALK vision was 20/30 two months after surgery. This report aims to show improved visual outcome in corneal ectasia secondary to HK. DALK can be a procedure of choice with proper case selection.

Key words: Corneal ectasia, deep anterior lamellar keratoplasty, hexagonal keratotomy, hyperopia

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Hexagonal keratotomy (HK) is an incisional surgery which is done for hyperopia, occurring either naturally or for hyperopia after radial keratotomy and presbyopia.^[1] HK is known to be associated with a high rate of complications, including keratectasia.^[2-5] Patients who develop such complications may sometimes require penetrating keratoplasty (PK) either because of contact lens intolerance or poor visual acuity secondary to irregular astigmatism.^[3,4] This case report aims to describe

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the management of corneal ectasia after HK by deep anterior lamellar keratoplasty (DALK). This is the first report of DALK applied in a case of post-HK ectasia.

Case Report

A 42-year-old gentleman presented with a complaint of defective vision in both eyes and fluctuating vision, polyopia, diplopia and watering, all symptoms more intensely experienced in the left more than right eye, for 4 years. He had undergone incisional refractive surgery for the correction of hyperopia in both eyes 20 years ago. The pre-surgical refractive error and the details of the surgery were not available. On examination, the best spectacle corrected visual acuity in the right eye was 20/30 with +1.75 D Sph and +2.25 D Cyl at 10° and in the left eye it was 20/400 with -11 D Sph and -7.00 D Cyl at 120°. Munson's sign was demonstrable on the downward gaze [Fig. 1].

Slit-lamp biomicroscopy of both corneas revealed multiple linear scars in a hexagonal pattern, of varying density and approximately 90% depth, in the paracentral area. There was a single hexagonal row of scars in the right eye and two in the left eye. The inner row in the left cornea showed an incomplete interconnected hexagonal ring, with dense leucomatous scarring between the 3'o clock and 6'o clock meridians [Fig. 2]. The central cornea within the incisions showed ectasia. Corneal topography (Keratograph Oculus, Wetzlar, Germany) showed simulated keratometry values of 47.9/45.2 Diopters at 91.8° in the right eye, with inferior corneal steepening. Simulated keratometry was 73.2/67.1 diopters at 133.3° in the left eye [Fig. 3]. The rest of the anterior and posterior segment examination was within normal limits in both eyes. He was diagnosed as post-HK ectasia. Rigid gas permeable contact lens trial was attempted for the left eye; however, a satisfactory fit could not be obtained.

Upon failing the contact lens trial, he was advised keratoplasty, and it was explained that DALK would be first attempted. The possibility of perforation and conversion to PK was explained as most of the scars in the incisional keratotomy appeared to be of 90% stromal depth.

Surgery was performed under standard peribulbar anesthesia. Honan's balloon was not applied because of the risk of incision rupture. An 8.5 mm graft was decided and an initial groove of one-third stromal thickness was made with the trephine. Then, with the help of a 15 no. blade on a Bard-Parker handle, this groove was deepened 360° to about three-fourths the depth. The blade was insinuated into the groove and lamellar dissection was carried out. A curved corneal scissors was inserted to excise the layers after sufficient initial dissection by the blade, taking care to keep the sharper tip of the scissors directed away from the bed. The scarred areas prevented continuous excision of the layer and there was resistance in these areas, where the tissue had to be dissected piecemeal. The incisions also opened up during the initial dissection; however, none of them extended till the Descemet's membrane (DM). About four layers were thus removed, until the DM was reached. Once it was confirmed that DM was clear of scar tissue, the donor button was trephined with a trephine of the same size and the donor DM was stripped. This was sutured to the recipient bed with 16 interrupted 10-0 nylon sutures.

Postoperatively, the patient was started on Prednisolone

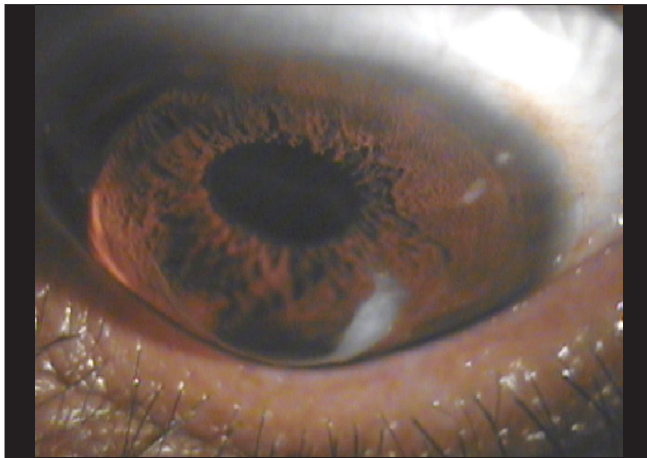


Figure 1: The left eye on down gaze showing Munson's sign

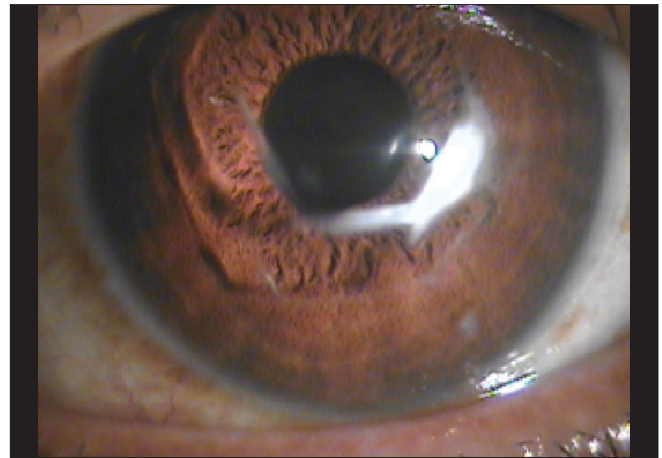


Figure 2: The left eye showing the incisions wherein the gap is widened; ectasia is present both in the incision and in the center

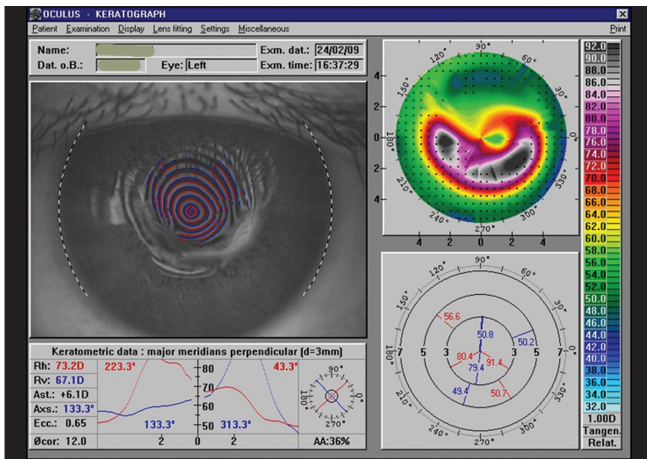


Figure 3: Preoperative topography shows high irregular astigmatism with inferior steepening in the area of ectasia

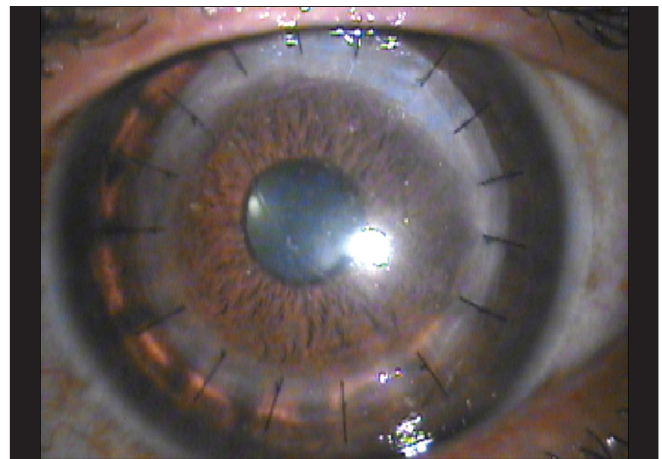


Figure 4: Lamellar graft 2 months postoperative with 16 sutures in situ showing clear graft

acetate 1% eye drops 6 times a day for the first 1 week and then tapered by one drop a week over 6 weeks, till one drop a day was continued indefinitely. Ciprofloxacin 0.03% eye drops was also given four times a day for the first 1 week and stopped. Two months later, the uncorrected visual acuity was 20/50 and the best spectacle corrected visual acuity was 20/30 with +3.00 D Sph and +4 D Cyl at 90° [Fig. 4]. The corneal topography showed significant flattening of the corneal surface postoperatively with simulated keratometry values of 45.6/39.5 at 176.7° [Fig. 5].

Discussion

HK was a technique used in the 1950s for correction of low hyperopia (+1 to +3 Diopters).^[3] Since then, it has been used with varying success for the correction of primary hyperopia, presbyopia and post-cataract surgery hyperopia. It is known to be associated with many complications, including unpredictable corrections, glare, photophobia, irregular astigmatism, corneal edema, microbial keratitis, perforations, abnormal wound healing and several more,^[3] so much so that closed HK (where the six incisions are connected) has now been abandoned and other HK procedures are generally

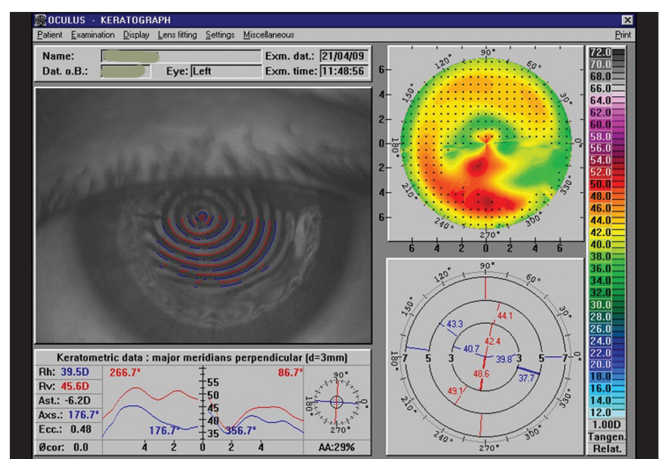


Figure 5: Post deep anterior lamellar keratoplasty topography showing significant flattening of the corneal surface

not recommended.^[3] Patients who have undergone these procedures years ago are still at risk of development of ectasia and may need PK.^[2-4] The mechanism of ectasia is attributed

to the interconnected incisions results with delayed healing in such eyes.^[2,4] While iatrogenic keratoconus has been reported after radial keratotomy, which was managed by PK,^[6] ectasia after HK has been less commonly reported. Wellish *et al.* had shown the occurrence of iatrogenic keratoconus in an apparently normal cornea after multiple enhancement procedures, which finally ended in a double HK.^[2] This patient was finally managed by PK. Other previous reports too have described PK as a management modality. The present report is the first to describe DALK in this condition.

In the era of lamellar surgeries, DALK is preferred over PK due to several advantages: fewer intraoperative complications due to closed globe surgery, rapid healing and superior wound strength (as the wound is not full thickness), no risk of endothelial rejection, (the main cause of graft failure after PK), no need for long-term topical corticosteroids and therefore a decreased risk of infection, glaucoma, and cataract.^[7] With the subtle microperforations which are known to occur after incisional surgery, DALK may be difficult as the risk of intraoperative anterior chamber entry increases during the stromal dissection, thus requiring on-table conversion to PK. Similar observation of DALK being technically more challenging in post-keratotomy eyes was made by Chamberlain *et al.*,^[8] who recently reported the use of the femtosecond laser, to perform a ziz-zag side incision pattern, in the corneal dissection which enabled successful big bubble formation in a case of post-Radial Keratotomy cornea. In our case, we avoided the big bubble technique as there could be escape of air anteriorly from the HK incisions or rupture of the DM due to microperforations. We were able to perform lamellar dissection layer by layer till the DM was exposed.^[9] Pre-operative

ultrasonic pachymetry (especially nine-point pachymetry, or at least the thinnest pachymetry) was not done here; however, it is recommended in such cases for proper surgical planning in lamellar surgery. Though DALK is a difficult procedure, it is a worthwhile alternative to PK in the correction of corneal ectasia following HK.

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