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Editorial

Deep Anterior lamellar Keratoplasty: In search of Holy Grail!



Deep Anterior lamellar Keratoplasty (DALK) has become the corneal transplantation technique of choice for corneal diseases that spare the corneal endothelium. The major indications include *keratoconus*, stromal corneal dystrophies, corneal scars that spare the Descemet membrane (DM) and recalcitrant infectious keratitis.^{1–4}

Unlike the old technique of penetrating/full thickness corneal transplantation, DALK is bereft of dreaded life time risks of *endothelial rejection*, Endothelial failure, secondary glaucoma etc and besides achieving excellent visual outcomes, DALK has all the advantages of a lamellar procedure: avoiding most complications associated with “*open-sky*” surgery of full thickness corneal transplantation.⁵ Gasset⁶ was the first to publish successful results of his DALK Technique in patients of keratoconus. Most of the patients (80%) in his series achieved a visual acuity of $\geq 20/30$.

The goal of DALK is to achieve a depth of dissection as close as possible to DM and various modalities have been used to create a plane of separation between DM and the deep stromal layers. These include manual dissection, air-assisted dissection,⁷ hydrodelamination,⁸ viscoelastic-assisted dissection,⁹ and femtosecond laser.¹⁰

Ophthalmic literature is full of various DALK techniques and their modifications, each claiming to be optimal, safe and more effective. All these techniques can be broadly classified in two major categories; *predescemetic DALK* and *descemetic DALK*. While *melles technique*¹¹ is the most popular predescemetic technique of DALK, Descemetic DALK is usually performed using *Big Bubble Technique*¹² in which air is injected in cornea to bare and separate healthy DM from rest of the diseased cornea. While both techniques deliver excellent visual outcomes, they are somewhat difficult to practice in cases of advanced keratoconus and very thin corneas. Also, each of these two techniques carry some inherent disadvantages that can preclude achievement of optimal results in a consistent manner. In *big bubble technique*, many times big bubble would not form and injection of air makes cornea emphysematous and opaque. Moreover, if DM perforates, a

conversion to a full thickness corneal transplantation with its intrinsic risks and complications is the usual outcome. In *melles technique*, the *closed method of lamellar dissection* is used and as the plane of dissection is not under direct visualization, chances of perforation are always possible.

Because of these major issues with two of the most commonly practiced techniques of DALK, I was always looking for some new technique of DALK that is safe, easy to perform, reproducible and uniformly applicable to different clinical situations.

In movie Indiana Jones and Last Crusade, Indiana played by Harrison Ford is advised by Grail Knight that “You must choose. But choose wisely, for as the true Grail will bring you life, the false grail will take it from you”. Whenever I had to perform a DALK in a patient of keratoconus, I had a similar question in mind. Which technique to choose from so many good techniques described in the literature? A wrong choice, a wrong move and consequent intraoperative perforation of DM would condemn the patient to lifelong risks of a full thickness corneal transplantation.

And my quest for finding ‘*Holy Grail of DALK*’ was helped by a remarkable publication of technological report of American Academy of Ophthalmology about outcomes of various techniques of DALK.¹³ The report concluded that DALK is equivalent to penetrating keratoplasty (PK) for the outcome measure of best spectacle corrected visual acuity (BSCVA), particularly if the surgical technique yields minimal residual host stromal thickness.

The gist of the recommendation that interested me was the correlation between residual bed thickness and the visual outcome of DALK. The report evaluated several studies of DALK and PK and found that visual and refractive outcomes to be comparable if the *residual bed thickness* in DALK cases are between 25 and 65 μm . Based on this paper we developed our own technique of DALK and called it *Dia-DALK*¹⁴ In concept, our technique is similar to Rama et al.¹⁵ manual technique of DALK. However, our technique does not require the use of a suction trephine to create initial incision.

Like any other predescemetic technique of DALK, Dia-Dalk when compared with big bubble DALK, takes a much longer time for achievement of optimal post-surgical visual

acuity. However, it scores over big bubble DALK in terms of wound strength and no risk of intraoperative conversion to PK.

In my experience, *Dia DALK* is a safe, predictable and effective technique of DALK that delivers optimal visual outcomes comparable to other popular modalities of DALK. The technique is much easier to learn and can successfully be performed even in cases extreme corneal ectasia. To me it is the *Holy Grail of DALK!*

Recently a new technique of enzyme assisted DALK that uses hyaluronidase and trypsin has been reported.^{16,17} These enzymes can effectively digest corneal stromal tissue and extracellular matrix to bare the DM successfully. These early results show that enzyme assisted DALK has a potential to replace big bubble DALK as a technique of choice for Descemetic DALK. Another future development might be an emergence of a safe femtosecond laser for deep lamellar dissection at the predecemetic plane with laser spots tracking along the posterior curvature of host cornea to achieve uniform depth dissection throughout the dissection plane and without causing any damage to the corneal endothelium. Actualization of such a concept, if happens, has the potential to become the ideal technique of DALK.

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