

Deep anterior lamellar keratoplasty (DALK) - the patient profile and the early outcome of surgery - a single centre experience

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Abstract

Introduction: The decision to offer DALK to patients, who cannot be adequately treated with glasses and contact lenses, is based on clinical judgement. Postoperative clinical parameters may be influenced by the lamellar dissection technique and suture tension and patient corneal characteristics like central corneal thickness. We describe a list of patients who underwent DALK with regard to parameters at the time of surgery and the refractive outcomes at one month post DALK.

Method: DALK done at Sri Jayewardenapura General Hospital (SJGH) from 2009 Dec to 2014 April were enrolled and their preoperative demographical and clinical data were collected. Those without complete preoperative data were excluded from the study to leave 71 eyes of 62 patients for analysis. Postoperative data of topography and refraction were collected at one month after surgery.

Results: Of the patients 72.9% were between 10 to 25 years and 24.2% were between 25 to 40 years. 53.5% were males. The left eye was operated in 52%. 66.1% had best corrected visual acuity (BCVA) of 6/18 or worse. The other 1/3 had 6/12 or better but could not tolerate the lenses. Pre operative diagnosis in 80% was keratoconus. Other indications for surgery were macular degeneration and corneal opacities. Pre operatively, central corneal thickness (CCT) was less than 400 in 55.2% and 400 to 450 in 36.2%. 81.8% had steep keratometry more than 56 Diopters (Ds). The Flat keratometry was more than 52 Ds in 70.3%. Spherical equivalent (SE) of -4.0 Ds or more myopic, was seen in 46.2% of patients. Post operatively all patients had Steep Keratometry less than 56 Ds. 96.3% had steep keratometry between 40 to 52 Ds. All patients had flat keratometry less than 52 Ds. 90.9% of were between 36 to 48 Ds. SE was -4 to 0 Ds in 58.5% and 0 to +4 Ds in 32%. BCVA was 6/6 in 1.9%, 6/9 28.3% and 6/12 in 60.4%.

At DALK surgery Anwar big bubble (ABB) was successful in 76.1% and layer by layer (LL) dissection was done in 23.9%. ABB and LL, BCVA at 1 month showed no statistical significant difference.

Conclusions: Individual corneal surgeons should develop their own refractive outcomes to assess surgical technique and consistency for DALK. Most patients in this study had 6/12 or better vision at one month post DALK.

Introduction

DALK is a well accepted method to treat corneal ectasia like keratoconus and corneal dystrophies not involving the endothelium. In patients with the above conditions, DALK is offered when adequate optical correction cannot be obtained with glasses or contact lenses or when such treatment is intolerable. Since it is a subjective patient preference that has to be relied upon when the final decision is made to offer surgery, there may be errors of judgement on when to offer such surgery.

Refraction, best corrected visual acuity, topography and pachymetry are useful clinical parameters to stage diseases like keratoconus. Therefore, it would be interesting to find out the clinical preoperative staging in patients who were offered DALK to treat the subjective visual complaints and treatment intolerance. At SJGH a single surgeon performs DALK. Therefore there is no inter-operator variability in terms of surgical technique. All patients had interrupted sutures placed. However In the postoperative period following DALK, scar formation and graft uptake results in changes in topography and refraction. Postoperative clinical parameters may be influenced by the lamellar dissection technique and suture tension. These factors may have inter patient variability. Therefore it is an ideal opportunity to describe the patient parameters at the time of surgery as well as the early surgical outcome at this setting. These findings may be useful for patient counselling as to what kind of visual outcome to be expected in the early post-operative period, as it may be the most important factor on the patients mind. Also each corneal surgeon may have different refractive outcome according to the surgical technique used. Therefore individual surgeons may need to develop their own refractive outcomes to assess consistency of surgery in DALK.

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Methodology

DALK was first introduced to SJGH in December 2009. It is a single surgeon station where the same surgeon performed all DALK and the decision to offer DALK was taken by him. The patient’s pre-operative data was collected and included with demographic data, pre-operative refraction, BCVA, topography and pachymetry. From 2009 Dec to 2014 April 116 DALK were performed at SJGH. Though all patients who had DALK were included in the study only 71 eyes of 62 patients could be enrolled due to incomplete data collection. Data was collected from clinical records and investigations and a data collection form was used to collect the data. The patients included in the study had a routine post-operative review at 1 month. At this review data on refraction, BCVA and topography were collected. Data collection was done by ophthalmology trainees and data was analysed using SPSS. The data collection is ongoing and this would be an interim report of findings for the period of Dec 2009 to April 2014.

Results

Of the patients 72.9% were between 10 to 25 years and 24.2% were between 25 to 40 years. 53.5% were males. The left eye was operated in 52%. 66.1% had BCVA of 6/18 or worse. The other 1/3 had 6/12 or better but

Table 1. Pre op best corrected visual acuity

<i>Pre op BCVA</i>	<i>Frequency</i>	<i>Percentage</i>
6/9	3	5.4
6/12	16	28.6
6/18	8	14.3
6/24	8	14.3
6/36	9	16.1
6/60	8	14.3
1/60	3	5.4
HM	1	1.8
Total	56	100.0

could not tolerate the lenses (See Table 1).

Preop diagnosis in 80% was keratoconus. Other indications were corneal degeneration (macular) and

Table 2. Pre operative pachymetry – taken at central 0 - 2 mm and minimum thickness in micrometers

<i>CCT at 0 - 2 in Pachymetry Min Thickness (micrometers) n=58</i>	<i>Number</i>	<i>Percentage</i>
304 to 350	08	13.8%
351 - 400	24	41.4%
401 - 450	21	36.2%
451 - 500	3	5.2%
501 - 896	2	3.4%
Total	58	100%

corneal opacities. Pre operative CCT was less than 400 in 55.2% and 400 to 450 in 36.2% (See Table 2).

Steep keratometry (K), 44 Diopters (Ds) to 48 was in 6.3%, 48 - 52 Ds in 7.2%, 52 - 56 Ds in 5.3%, 56 - 60 Ds in 23.2%, 60 - 64 Ds in 21.5%, 64 - 68 Ds 23.2%, 68 - 72 Ds 5.3%. Flat K 44 Ds to 48 was in 12.2%, 48 - 52 Ds in 17.5%, 52 - 56 Ds in 22.8%, 56 - 60 Ds in 26.4%, 60 - 64 Ds in 10.5%, 64 - 68 Ds 1.7%.

Average Keratometry was less than 44 in 8.6%, 44 to 48 in 3.4%, 48 to 52 in 8.6%, 52 to 56 in 20.8% 56 to 60 was 24.1%, 60 to 64 in 24.1%, more than 64 in 10.4%. SE of - 4.0Ds or more myopic, was seen in 46.2% of patients (See Table 3).

Table 3. Pre operative spherical equivalent in diopters

<i>Pre op Spherical equivalent in diopters</i>	<i>Number</i>	<i>Percentage</i>
More than + 4.00	1	1.9%
+ 4.00 to 0	2	3.9%
0 to -4	27	48%
- 4 to -8	15	25%
- 8 to -12	5	9.7%
More than minus 12	6	11.5%
Total	56	100%

Anwar big bubble (ABB) was successful in 76.1% and layer by layer (LL) dissection was done in 23.9%.

At post operative one month the topography results were, steep keratometry (K) 36 - 40 Diopters (Ds) 1.9%, 40 - 44 Ds 22.2%, 44 - 48 Ds 53.7%, 48 - 52 Ds 20.4%, 52 - 56 Ds 1.8% and flat K results were 32 - 36 Ds 7.3%, 36 - 40 Ds 45.4%, 40 - 44 Ds 34.6%, 44 - 48 Ds 7.3%, 48 - 52 Ds 1.8%.

Average keratometry was less than 36 Ds in 1.8%, 36 to 40 in 9.1%, 40 to 44 in 50.9%, 44 to 48 in 34.5%, more than 48 in 3.7%.

Topographic cylinder at 1 month was 0 to -4 Ds in 26.8%, -4 to -8 Ds in 44.7% and -8 to -12 Ds in 23.2%. Refraction cylinder was 0 to -4 Ds in 57.4%, -4 to -8 Ds in 38.9% and -8 to -12 Ds in 3.7%.

SE was -4 to 0Ds in 58.5% and 0 to +4Ds in 32% (See Table 4).

Table 4. Post op spherical equivalent at 1 month

<i>Post op spherical equivalent in diopters</i>	<i>Number</i>	<i>Percentage</i>
More than -4	2	3.8%
-4 to 0	31	58.5%
0 to +4	17	32%
More than +4	3	5.7%
Total	53	100%

BCVA was 6/6 in 1.9%, 6/9 or better in 28.3% and 6/12 or better in 60.4% (See Table 5).

Table 5. Post op best corrected visual acuity at 1 month

<i>Post op BCVA</i>	<i>Number</i>	<i>Percent</i>
6/6	1	1.9
6/9	14	26.4
6/12	17	32.1
6/18	13	24.5
6/24	3	5.7
6/36	2	3.8
6/60	2	3.8
HM	1	1.9
Total	53	100

ABB and LL BCVA at 1 month was 6/12 or better in 63% and 50% respectively. There was no statistically significant difference.

Discussion

In this study the majority who had DALK are young patients with keratoconus. It is the most productive part of the life for these patients in terms of education and career development. Therefore the decision to offer timely surgery becomes imperative. It is still the patients' visual requirement and tolerability of eyewear that is considered when offering surgery. There are no guidelines set to aid the decision to offer DALK. At the time when these patients required surgery majority had moderate to severe keratoconus. Also visual acuity in a majority were 6/18 or less. This is when useful vision is reduced and the patients need or request intervention.

Pre operatively, 81.8% had steep keratometry more than 56 Ds. Post operatively all patients had steep keratometry less than 56 Ds and 96.3% had steep keratometry between 40 to 52 Ds. The flat keratometry pre operatively was more than 52 Ds in 70.3%. All patients had flat keratometry less than 52 Ds post operatively and 90.9% were between 36 to 48 Ds. The Average keratometry pre operatively was more than 52 Ds in 79.6% whereas the post operative average keratometry was between 40 to 48 Ds in 85.4%. Each surgeon may have initial differences in these outcomes at one month according to the suture technique as well as suture tension used. It would be most important to know the individual surgeon outcomes as the first month topography may be directly related to surgical technique. With time due to scar formation these numbers would change when the patient factors come into play. If an individual surgeon can find post operative patients within his normal range at the first month evaluation, it may mean that the surgery on that patient had been consistent.

Post operatively 67.9% had topography cylinder between -4 Ds to -12 Ds and 42.6% had refraction cylinder between -4 to -12 diopters. At one month it may be impractical to give glasses to most patients. Those who had cylinders between 0 -4 Ds may be able to tolerate glasses. Therefore, post operative cylinder could be a factor in early return to gainful daily visual activity. Pre operative myopia as shown by the SE was -4.0 Ds or more in 46.2% of patients. Post operatively SE in 90.5% was less than -4 Ds. The residual myopia may be due to axial myopia in this age group. Most patients had BCVA of 6/12 or better at post op 1 month. DALK rendered at least one line improvement in patients with BCVA of 6/18 and more improvement than that in with patients with poorer vision. It could be suggested that patients with poorer vision could look forward to a larger change of vision after DALK.

In this setting a post operative vision of 6/12 at one month, may suggest good surgical outcome. It is important to note that these outcomes may differ from surgeon to surgeon. Therefore each operator should audit their individual outcomes to assess which patients may benefit from early suture manipulation and to assess success of DALK procedure.

The lamellar dissection technique does not appear to influence the BCVA at one month postoperatively. It may be because that the graft host interaction or the difference of it between the two types of lamellar dissection may come into play only later, with the wound healing and scar formation. Also, how good the manual dissection at the visual axis may be important in this outcome. It could be argued that if the visual axis had a good manual dissection that

would be akin to a big bubble dissection. In this setting a BCVA less than 6/12 in a manual dissection may denote inadequate clearance. It would be interesting to note how the BCVA behaves in patients with manual dissection as further data is collected.

Conclusion

DALK done at SJGH has shown that it is important to develop individual refractive outcomes for corneal surgeons performing DALK to assess surgical technique and consistency. Though it would be difficult to use as a guide for other settings it is useful to note that BCVA of 6/12 at one month post operatively may be attributed to a good surgical outcome. Further collection of data and evaluation is necessary to confirm these outcomes.