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Comparision of Deep Lamellar Keratoplasty and Penetrating Keratoplasty in Acanthamoeba Keratitis: Review of 40 Cases

Dr. Bhupesh Bagga, Dr. Jagdish Reddy, Hasnat Ali, Dr. Somasheila Murthy, Dr. Prashant Garg

Acanthamoeba is a free-living protozoan that is seen in air, soil, dust and water. Life cycle consists of two stages trophozoite and cyst stages. Acanthamoeba keratitis is mostly prevalent in countries where contact lens use is more, but other predisposing factors like trauma and surgery have been reported. In the recent past there is increase trend in Acanthamoeba keratitis either due to contact lens solution, contact lens material change in water supply or environmental factors, poor socioeconomic conditions.

Management of Acanthamoeba keratitis comprises of medical and surgical therapy. Medical therapy includes antiacanthamoeba medication and topical and oral steroids. The surgical therapies for Acanthamoeba keratitis include amniotic membrane transplantation keratectomy Penetrating Keratoplasty (PK) and deep anterior lamellar Keratoplasty (DALK). Surgical options primarily depend upon the level of involvement into cornea. Till recently Penetrating keratoplasty was considered to be the standard of care for infections not responding by medical management. Although literature is available for performing DALK in cases of Acanthamoeba keratitis, there is no study to compare the outcomes in terms of eradication of infection and visual rehabilitation available. Purpose of the present study is to compare between these two.

MATERIALS AND METHODS

We reviewed charts of all microbiologically proven Acanthamoeba Keratitis in whom surgical interventions in terms of either Penetrating keratoplasty (PK) or Deep Anterior Lamellar Keratoplasty (DALK) were performed. Based on the positive smear report or culture reports medical therapy including topical polyhexamidine methylene biguanide (PHMB) 0.02%, chlorhexidine 0.02% every hourly application and atropine sulphate 1% three times are used. Surgical treatment is opted in cases in which the keratitis was severe at presentation or not responding to medical treatment. Penetrating keratoplasty is performed in cases of full thickness corneal abscess or impending perforation. DALK is
preferred over PK in cases with infiltrate confining to ant–midstroma, presence of deep vascularisation, near limbal involvement after explaining the patient the possibility of intraoperative conversion to PK.

Post-operative regimen was essentially similar in all cases that is continue antiacathamoba medications (PHMB 0.02% and Chlorhexidine 0.02% eye drops) in 1 hrly along with Prednisolone acetae eye drop 1% 6 times in day to be continued for 1 month. Steroids were tapered gradually in year.

**RESULTS**

Of the 40 eyes of 40 patients 18 eyes underwent DALK, 22 eyes underwent PK. 3 were converted to PK. Mean age and gender of patients in DALK and PK groups were matched. Size of infiltrate ranged from 4-10 mm in both the groups. Perforated corneal ulcer was seen in 3 eyes. Limbal involvement was seen in 3 of DALK cases and 2 in PK cases. Deep Vessels are present in 10 of 18 cases Of DALK group and 8 of 22 cases in PK group. Recurrence: There were 2 in 18 cases of DALK cases and 1 in 22 cases of recurrence in PK with OR 0.12(P<0.01) as compared to PK OR 0.04 (P-0.02). Visual Acuity: DALK Group: The result indicates that the median logMAR Visual Acuity of Pre-op, compared to median logMAR Visual Acuity at 1 month follow-up, is higher on the average; but the difference is not statistically significant at 5% level. However, at 3 month follow-up and at 12 month follow-up the difference is statistically significant. (Fig-1, Table 2 and 3). PK Group: The median visual Acuity of Pre-op, compared to median VA at 1 month, at 3 month and at 12 month, the difference is not statistically significant at 5% level. The difference of visual Acuity between Pre-op and at 1 Month of DALK, compared to difference of visual Acuity between Pre-op and at 1 Month of PK, is higher on the average; but it’s not statistically significant. However, the differences at 3 Month and at 12 Month are statistically significant at 5% level. Graft survival analysis by Kaplan Meir Analysis was done which showed 60% of Corneal graft remained clear in DALK group Vs 20% in PK group for 12 months or longer follow-up (Fig-2).
**Table 1**

<table>
<thead>
<tr>
<th></th>
<th>Pre-op and 1st month</th>
<th>Pre-op and 3 month</th>
<th>Pre-op and 12 month</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DALK</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P-value</td>
<td>0.160</td>
<td>0.001</td>
<td>0.022</td>
</tr>
<tr>
<td>Confidence interval</td>
<td>(-0.009, 0.830)</td>
<td>(0.469, 1.529)</td>
<td>(1.040, 1.836)</td>
</tr>
<tr>
<td><strong>PK</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P-value</td>
<td>0.262</td>
<td>0.141</td>
<td>1</td>
</tr>
<tr>
<td>Confidence interval</td>
<td>(-0.350, 1.166)</td>
<td>(-0.350, 1.270)</td>
<td>(-1.469, 1.893)</td>
</tr>
</tbody>
</table>

**DISCUSSION**

DALK in Infectious keratitis is a known procedure. It has advantage of preserving patient’s own endothelium in addition to eradication of infection. But in presence of stromal infiltrate and necrosis eye it is difficult to perform bigbubble or manual dissection. There is always a risk of leaving stroma with organism. But as we have shown in our series chances of recurrence is seen in only 2 cases, Visual outcome in DALK group is better than PK group. It is always important to bare entire stroma from the Descemet’s membrane. Although size of infiltrate in two groups is comparable, depth of involvement varied from case to case. We also showed role of steroids starting first post operative day in reduction of inflammation and better survival of graft along with antiacanthamoeba keratitis. Considering all the facts mentioned, it seems to be rationale to have a step wise approach in management of Acanthamoeba keratitis. DALK should be considered as a first surgical option in cases being worsened with medical treatment.

**REFERENCES**

Crystal Clear Graft-The Bare Minimum!

Dr. Kalpana Suresh, Dr. Meghana Koorapati, Dr. Varshini Vardaraj, Dr. Ramya Ravindran, Dr. Soly Somapalan

A major decrease in the corneal endothelial cell population after penetrating keratoplasty occurs in the first year. At three months this decrease is between 18% and 24%, and by the end of one year between 34% and 45%. Thereafter, despite a small degree of continuous cell loss, corneal grafts have a favourable prognosis for long term clinical stability. However, the endothelial cell density does not always correlate well with the endothelial function. In the long run, this continuous decrease in endothelial cell count, and their concomitant increase in size and shape are accompanied by a decreased ability to maintain and restore pump and barrier function. Thus, when the endothelial cell count goes below 700 cells/mm², the functional reserve is minimum and corneal oedema is likely to occur.

Aim and objects of this study is to assess the donor graft status by specular microscopy (endothelial cell count and corneal thickness) and correlate it with graft clarity in 57 post penetrating keratoplasty cases.

**MATERIALS AND METHODS**

Between the period of May 2010 and May 2011 57 post penetrating keratoplasty patients with clear grafts had presented to the cornea clinic for review, their surgeries were keratoplasty including ECCE with posterior chamber intraocular lens implantation, trabeculectomy, anterior vitrectomy, intraocular lens removal, pupilloplasty was recorded.

During follow up; the BCVA, the clarity of the graft, vascularization, presence or absence of glaucoma, uveitis, and refractive state of the grafted eye were assessed and recorded. The corneal thickness and the endothelial cell density
of the grafted cornea were also recorded using a specular microscopy for the 57 patients with clear grafts. Out of the 57 clear grafts 32 patients were post penetrating keratoplasty, 7 patients were post triple procedure, 10 patients underwent Penetrating keratoplasty with anterior vitrectomy and 8 patients underwent Penetrating Keratoplasty with IOL explantation with PCIOL implantation. For all these patients specular microscopy and pachymetry were done and endothelial cell density and central corneal thickness was done.

RESULT
The endothelial cell count ranged from 566-1690 cells/sq. mm with a mean of 981.3 and pachymetry of 429-605 micrometers with a mean of 518.2. Post-operative follow up was for a period of 10 years. Correlation co-efficient was 0.52 between endothelial cell count and central corneal thickness. It was found to have a moderate positive correlation (p<0.0001).

DISCUSSION
Average endothelial cell density in the study among the 57 clear grafts was found to be 981.3 and average central corneal thickness was 518.2. Post-op Pachymetry was done for these patients to calculate these parameters. In the long run, the continuous decrease in endothelial cell count, and their concomitant increase in size and shape are accompanied by a decrease ability to maintain and restore pump and barrier function. It is always assumed that a low endothelial cell count is a major cause for the decompensation in the graft.

In a study conducted by Lass, it was found that does not necessarily mean graft failure in an otherwise clear graft. However if there is an indication that the graft is failing or any suggestion that the cornea is developing folds or an increase in thickness, a cell count has to be obtained at that point because a graft rejection episode at this time is something that can tip the cornea to fail.1

Thus, when the endothelial cell count goes below 700 cells/mm², the functional reserve is minimum and corneal edema is likely to occur.2 A few authors would put this number at 400-500 cells/mm².3 Although this is the critical endothelial cell density below which corneal deturgescence cannot be maintained and irreversible oedema occurs, early specular microscopy study showed that a surprisingly low endothelial cell density can maintain the cornea in a dehydrated, transparent state.

Because a grafted cornea can remain transparent and support 20/20 vision with less than 20 percent of its normal endothelial cell density, specular microscopy is needed to accurately distinguish between a clear corneal transplant with extensive cell loss and one with virtually no cell loss.4

Endothelial cell loss occurs faster in a transplanted cornea than in the unoperated cornea after intraocular surgery, suggesting a greater vulnerability in the grafted endothelium. There is also evidence that the endothelium of a corneal graft
remains in a state of transition for a considerable length of time post-operatively, seeming to reflect a prolonged healing process. Cell density may decrease, and mean cell area increases with time. These changes are progressive and may continue for months and perhaps for years after surgery. Should progressive cell loss continue to occur, this would explain the sudden decompensation of some grafted corneas years after successful corneal transplantation surgery.

Patel, et. al., reported that for the 24 clear grafts at 15 years after surgery, endothelial cell density was 872 ± 233 cells/mm² and central corneal thickness was 0.61 ± 0.05mm.\textsuperscript{5}

Bourne, et. al., found a major decrease in the corneal endothelial cell population after penetrating keratoplasty occurs in the first year. At three months this decrease is between 18% and 24%, and by the end of one year between 34% and 45% and found a significant statistical correlation (p<0.001).\textsuperscript{6}

Hence we have found in our study that as long as a minimum endothelial cell count is maintained graft clarity is ensured above this critical number an increase in the endothelial count does not make a significant difference.

REFERENCES
1. Jonathan H.Lass M.D, Post op cell density for predicting graft failure; Cornea; newsletter ASCRS.

Outcome of Mushroom Shaped Femtosecond Laser Assisted Penetrating Keratoplasty for Keratoconus

Dr. Ashwini Ranganath, Dr. Himanshu Matalia, Dr. Rohit Shetty, Dr. Bhujang Shetty

Penetrating keratoplasty is one of the most commonly performed tissue transplants in the world today.\textsuperscript{1} Although traditional penetrating
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Keratoplasty (PK) can provide excellent clinical results for patients with significant visual loss from corneal disease, visual rehabilitation is often prolonged. The significant factor for this is postoperative astigmatism, both geometrically regular and irregular, which remains a major obstacle in the functional rehabilitation of patients with clear corneal transplant. Sources of optical distortion include misalignment of the anterior surface of the donor and host; rotational misalignment, where the tissue is not precisely distributed; excess and uneven suture tension; and postoperative slow and uneven wound healing.2 Historically, endothelial cell survival, preservation of corneal clarity, and graft rejection have been the primary outcome measures following penetrating keratoplasty.3,4,5 More recently, greater emphasis has been placed on the speed and extent of visual rehabilitation, with many reports investigating the impact of intra-operative suturing techniques, postoperative suture adjustment, suture removal strategies, and correction of residual astigmatism.6,7,8 Unfortunately, it often still takes two years or longer to achieve final visual rehabilitation after PK.9

MATERIALS AND METHODS

It was a prospective interventional case study that was approved by the institutional ethics committee. Patients attending cornea clinic in Narayana Nethralaya Hospital, diagnosed to have keratoconus, undergoing corneal transplantation were included in the study. Size of study population was 31 eyes.

All patients underwent a preoperative evaluation including uncorrected and best corrected visual acuity, refractive error, slit lamp exam of anterior segment, dilated fundus evaluation, intraocular pressure measurement using Goldmann’s applanation tonometry, corneal topography assessed using Pentacam (Oculus), corneal pachymetry, endothelial cell count of donor cornea and clinical photograph of anterior segment.

26 patients underwent Femtosecond Laser assisted penetrating keratoplasty, mushroom configuration, (mushroom FLAK) using 60 kHz INTRALASE Fs Laser. 5 patients underwent the procedure using FS200 waveight Fs laser.

The donor graft was secured to the host using 16 interrupted sutures of 10-0 nylon.

All the patients underwent regular post operative assessment at 1, 3, 6, 12, 18 and 24 months respectively.

At all visits they were assessed for: Uncorrected visual acuity, refraction, best corrected visual acuity, slit lamp bio-microscopy, measurement of IOP using Goldman's applanation tonometer, corneal topography measured using Pentacam (Oculus), study of corneal wound healing using Anterior
Segment Optical Coherence Tomography (Casia, Tomey 3D, CAS OCT, SS-1000), endothelial count of the cornea (starting from the 3rd month follow up) (TOMEY, EM-3000) and clinical photograph of anterior segment.

RESULTS
The mean duration of follow up was 20.23±4.55 months (12-24 months). All 26 patients had a minimum follow up of 12 months. 21 patients (80.76%) had a follow up of 18 months and 13 patients had a maximum follow up of 24 months (50%).

Patient no. 11 was an extreme outlier with respect to UCVA, BCVA, cylinder and spherical equivalent from 3rd postoperative month. We therefore excluded this patient from statistical analysis from 3rd postoperative month.

Gender distribution – 16 patients were female and 17 were male.

Age distribution - The mean ± SD age of the included subjects was 24.04 ± 9.76 years, ranging from 9 to 50 years, out of which 8 patients were in the pediatric age group.

UCVA and BCVA

<table>
<thead>
<tr>
<th></th>
<th>UCVA ± SD</th>
<th>BCVA ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-op</td>
<td>0.05 ± 0.06</td>
<td>0.18 ± 0.17</td>
</tr>
<tr>
<td>1 Month</td>
<td>0.29 ± 0.17</td>
<td>0.60 ± 0.2</td>
</tr>
<tr>
<td>3 Months</td>
<td>0.33 ± 0.17</td>
<td>0.60 ± 0.18</td>
</tr>
<tr>
<td>6 Months</td>
<td>0.37 ± 0.15</td>
<td>0.66 ± 0.19</td>
</tr>
<tr>
<td>12 Months</td>
<td>0.42 ± 0.24</td>
<td>0.72 ± 0.23</td>
</tr>
<tr>
<td>18 Months</td>
<td>0.40 ± 0.15</td>
<td>0.68 ± 0.20</td>
</tr>
<tr>
<td>24 Months</td>
<td>0.44 ± 0.16</td>
<td>0.67 ± 0.17</td>
</tr>
</tbody>
</table>

Manifest Cylinder

<table>
<thead>
<tr>
<th></th>
<th>Mean±SD</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-op</td>
<td>5.25±2.33</td>
<td>4.26 to 6.23</td>
</tr>
<tr>
<td>1 month</td>
<td>3.58±1.94</td>
<td>2.79 to 4.36</td>
</tr>
<tr>
<td>3 months</td>
<td>3.89±1.75</td>
<td>3.15 to 4.62</td>
</tr>
<tr>
<td>6 months</td>
<td>3.43±2.05</td>
<td>2.56 to 4.29</td>
</tr>
<tr>
<td>12 months</td>
<td>2.97±1.96</td>
<td>2.16 to 3.78</td>
</tr>
<tr>
<td>18 months</td>
<td>2.45±1.47</td>
<td>1.76 to 3.14</td>
</tr>
<tr>
<td>24 months</td>
<td>2.08±1.58</td>
<td>1.12 to 3.03</td>
</tr>
</tbody>
</table>

Corneal Topography

<table>
<thead>
<tr>
<th></th>
<th>K1</th>
<th>K2</th>
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</thead>
<tbody>
<tr>
<td>Pre-op</td>
<td>60.58 ± 7.19</td>
<td>65.51 ± 7.99</td>
</tr>
<tr>
<td>1 Month</td>
<td>42.87 ± 7.54</td>
<td>51.31 ± 7.49</td>
</tr>
<tr>
<td>3 Months</td>
<td>41.01 ± 3.37</td>
<td>48.14 ± 2.82</td>
</tr>
<tr>
<td>6 Months</td>
<td>41.33 ± 3.17</td>
<td>47.81 ± 2.64</td>
</tr>
<tr>
<td>12 Months</td>
<td>40.40 ± 9.09</td>
<td>45.82 ± 9.68</td>
</tr>
<tr>
<td>18 Months</td>
<td>42.93 ± 3.38</td>
<td>47.39 ± 3.06</td>
</tr>
<tr>
<td>24 Months</td>
<td>41.83 ± 2.50</td>
<td>46.35 ± 2.52</td>
</tr>
</tbody>
</table>
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Endothelial Count

<table>
<thead>
<tr>
<th>Endothelial Cell Count (Cells/Mm³)</th>
<th>Endothelial Cell Loss (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-op</td>
<td>2897.27±178.7</td>
</tr>
<tr>
<td>3 Months</td>
<td>2593.3±204.88</td>
</tr>
<tr>
<td>6 Months</td>
<td>2279.29±266.074</td>
</tr>
<tr>
<td>12 Months</td>
<td>1993.38±286.01</td>
</tr>
</tbody>
</table>

Anterior Segment OCT

The graft-host apposition was excellent, with both the anterior and posterior corneal surfaces showing good alignment. The wound edge, displaying the mushroom pattern cut, showed good scar formation with increased signal, as early as 1 month, with increasing signal intensity over subsequent follow ups. The stability was maintained at all times till the latest follow up.

DISCUSSION

The mean BCVA at 1 year in our series was 20/30, which is a better result than that seen with manual trephination.\(^{10}\)

Mean residual astigmatism in our series is 3.58±1.94 D, 3.89±1.75 D, 3.43±2.05 D and 2.97±1.96 D, at 1, 3, 6 and 12 months, which is comparable with previous studies.\(^{1,11}\)

The mean endothelial cell loss noted in a previous study at 1 year has been 34±22%. In our study we have noted a mean endothelial loss of 30.91 ± 11.25%.\(^{12}\)

Our results show a superior visual outcome of mushroom FLAK compared to conventional PK. This may be due to the superior graft host apposition achieved with FLAK, stable graft contour and less chances of slippage at the graft host junction due to stepped corneal incisions.

Mushroom shaped graft is superior to the straight cut or other shaped grafts in the following ways:

Large diameter cut anteriorly ensures that the sutures are taken as far away from the visual axis as possible, thereby minimizing the effect of suture induced astigmatism in the visual axis.

Smaller diameter cut posteriorly provides lesser amount of donor endothelium, thereby minimizing the antigenic load from the donor endothelium, which may reduce the chance of endothelial rejection. This is advantageous in corneal ectatic disorders like keratoconus where the host endothelium is essentially normal.
The early stabilization of astigmatism may also be due to the smaller and less tight sutures taken in mushroom FLAK compared to manual PK.

Mushroom-shaped graft is superior to straight cut graft, as it can combine the benefits of a good visual acuity, a low astigmatism, rapid postoperative healing and possible increased long term survival of the graft.

In conclusion Mushroom FLAK is a safe procedure. It provides early visual rehabilitation, faster topographic stabilization, rapid and superior wound healing and maintenance of stable graft contour. Mushroom configuration of corneal graft is particularly advantageous in corneal diseases like keratoconus.

REFERENCES


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Outcomes of Descemet’s Stripping Endothelial Keratoplasty in Eyes with Failed Graft

Dr. Sunita Chaurasia, Dr. Muralidhar Ramappa, Dr. Pravin K. Vaddavalli, Dr. Virender S. Sangwan

Failed grafts after previous penetrating keratoplasty are a common indication for corneal transplantation. In the recent past, the conventional approach towards a failed graft was to perform a repeat penetrating keratoplasty. However, repeat penetrating keratoplasty involves a much prolonged period of visual recovery and close monitoring of suture management and its related complications.

In the recent years, endothelial keratoplasty has become a preferred procedure for all corneal diseases selectively affecting the endothelium. The technique has various advantages over traditional penetrating keratoplasty such as maintaining the structural integrity, avoidance of suture related complications and rapid visual rehabilitation. The literature on endothelial keratoplasty for failed penetrating grafts is limited to small case series. We report the outcomes of Descemet’s stripping endothelial keratoplasty (DSEK) in eyes with failed graft due to varied etiologies.

MATERIALS AND METHODS

This was a retrospective analysis of 30 eyes of 30 patients who underwent DSEK for failed graft between January 2009 to February 2010, at LV Prasad Eye Institute, India. Data analyzed included demographics, indication of primary penetrating keratoplasty, and cause of graft failure, duration of graft edema prior to DSEK, intraoperative and post operative outcomes and adverse events till the last follow up visit. The clinical outcome parameters studied were resolution of graft edema, graft transparency and visual acuity.

RESULTS

The mean age was 38.1±17.31 years (range 13 to 69 years). Thirteen were females and 17 were males. The indications for initial PK were ectatic corneal disorder (2 patients), corneal scar (3 patients), Fuch’s endothelial dystrophy (2 patients), Pseudophakic corneal edema (4 patients), congenital hereditary endothelial dystrophy (CHED) (4 patients), therapeutic grafts (15 patients) [Table 1]. Based on the indications for initial PK, two groups were studied: Group 1 included patients who had optical penetrating keratoplasty (n=15) and Group 2 comprised of patients with failed graft following therapeutic penetrating keratoplasty (n=15). Tables 2 summarize the demographics, pre-operative and post operative clinical data in the two groups.
The cause of failed graft in Group 1 was due to allograft rejection in all, except in one where late donor failure was noticed at 4 years. The mean duration between the onset of graft edema to DSEK surgery was 5.57±2.7 months (range 1 to 12 months) overall and on comparison between Groups 1 and 2, it was 6.8±3.05 months and 4.33±1.59 months, respectively. In Group 2, 4/15 patients underwent additional cataract surgery with posterior chamber intraocular lens (PCIOL) implantation, 5/15 also had synechiolysis done at the time of surgery. Overall, 12/30 patients (40%) were pseudophakic; with a PCIOL and remaining 18/30(60%) were phakic.

The average time required for resolution of graft edema after DSEK was 24.69±18.24 days (4- 44 days); 16.14±11.46 days (4-42 days) in Group 1 and 34.67±20.0 days (7-74 days) in Group 2. On comparing the two groups, graft edema resolution time was longer in Group 2 (P=0.007).Graft transparency was restored in 14/15 (93.3%) patients in Group 1. In Group 2, 5/15 (33.3%) had clear grafts and 6/15 (40%) patients had associated with sub epithelial, stromal or interface haze, accounting for suboptimal graft clarity in these cases. Three patients developed primary graft failure and one patient had interface infiltrate on the fifth post operative day which eventually required therapeutic penetrating keratoplasty.

The preoperative visual acuity was <20/400 in all patients. Post-operative visual acuity was ≥20/40 in 14/30 eyes (46.6%), 20/100 -20/40 in 8/30 eyes (26.6%), <20/200 in 8/30 eyes (26.6%). In Group 1, 11/15 (73.3%) had vision 20/40 or better, remaining 3/15 (20%) had vision of 20/200 to 20/100. Of these 3, 2 patients were amblyopic, 1 had optic nerve pathology. In Group 2, 3/15(20%) had vision of 20/40 or better, 7/15(46.6%) had vision between 20/100 to 20/40, 5/15(33.3%) had vision <20/200. One patient in this group had poor vision due to cataract.

The post-operative complications noted were graft rejection (4 patients), traumatic graft host junction dehiscence (1patient), interface infiltrate (1 patient), pupillary block progressing to angle closure glaucoma (1 patient), and primary graft failure (3 patients). Two patients had graft rejection after one year and two developed rejection within the first year of surgery. Graft rejection recovered in 3 patients; in one patient, it progressed to graft failure.

The mean endothelial cell density loss was 31.59±15.28% at 6 months. The baseline mean endothelial cell density was 2813.87±322.73 cells/mm² in Group 1 and 2784.53±315.74 cells/mm² in Group 2. The mean cell density loss at 6 months was 30.27 ±10.55% cells/mm² in Group 1 and 33.05±19.77% cells/mm² in Group 2. There was no statistical difference between the two groups.

The mean follow up period was 10.7±5.67 months (range 4- 20 months). Follow up was comparable for Groups 1 and 2.
Penetrating keratoplasty (PK) remains the surgical option for corneal blindness. High contrast visual acuity (HCVA), also known as best spectacle-corrected visual acuity, has been the usual visual outcome measure for PK, but the inadequacy of HCVA as an indicator of visual quality is widely appreciated.

A number of patients with clear corneal grafts may still have poor visual function postoperatively due to irregular astigmatism or other complications. Surgeons usually evaluate the results of a penetrating keratoplasty by conventional measures such as Snellen visual acuity and keratometry. Although these instruments are helpful in measuring important indices associated with visual function, they do not necessarily correlate precisely with a patient’s visual quality and satisfaction. Therefore, the surgeon’s definition of a “successful” corneal graft may not accurately reflect the patient’s perception of success as some patients report dissatisfaction with their vision.

Analysis of other parameters like contrast sensitivity, changed ratio of curvature between anterior and posterior corneal surfaces and corneal asphericity measurements using Orbscan provide important information on visual performances of these patients. In addition a questionnaire assessing the functional activities of daily living provides a better approach to the quality of life. In the present study we tried to assess the quality of vision after PKP by considering the following parameters.

- Corneal astigmatism
- Anterior corneal elevation and posterior elevation in corneal graft.
- The effect of graft size on 3 mm and 5 mm zone irregularity.
- The asphericity of cornea (Q value) and its impact on visual acuity
- Contrast Sensitivity
- VF-14 questionnaire for quality of life

**MATERIALS AND METHODS**

In a cross sectional non-interventional study conducted at Bangalore west Lions super speciality eye hospital, Bangalore between Feb 2010 and September 2010, 30 eyes of 27 patients were analysed.

**Inclusion Criteria:** Clear grafts 1 year after surgery following complete suture removal, best corrected vision ≥ than 6/24, with no surface problems.
Exclusion Criteria: Ocular surface disorders and other ocular disorders, Grafts with previous rejection episodes, Re- graft, Therapeutic or tectonic graft, age < 14 years.

The Medical records were reviewed for pre-operative diagnosis, surgical technique and if any complications noted. The entire donor corneas were preserved in MK media. Astigmatism was measured by manual and automated keratometer. All the patients underwent detailed analysis by scanning slit topography (orbscan) to obtain Sim K astigmatism, anterior and posterior elevation, 3 and 5 mm zone irregularity, central pachymetry and asphericity of the graft. Contrast sensitivity measurements were done using CSV-1000E. The visual function and symptom questionnaire were recorded by trained staff using VF-14 questionnaire. (This is based on 14 vision dependent activities of daily living such as reading, driving and cooking etc., wherein the patient was asked how much difficulty he/she faced in performing each activity). Statistical software namely SPSS 15.0, Stata 8.0, MedCale 9.0.1 and Systat 11.0 were used to analyse the data.

RESULTS

The mean age of the patients was 31.13±12.15 years. There were 62.96% males and 37.04% females with ratio being 0.59.

<table>
<thead>
<tr>
<th>Eye involved</th>
<th>No of eyes</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right</td>
<td>17</td>
<td>43.3</td>
</tr>
<tr>
<td>Left</td>
<td>13</td>
<td>56.7</td>
</tr>
</tbody>
</table>

The most common indication for surgery was keratoconus (46.67%) followed by corneal dystrophy (33.34%) and leucoma(16.67%).

<table>
<thead>
<tr>
<th>Visual acuity</th>
<th>No. of eyes</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/6-6/9</td>
<td>16</td>
<td>53.3</td>
</tr>
<tr>
<td>6/9-6/12</td>
<td>8</td>
<td>26.7</td>
</tr>
<tr>
<td>6/12-6/18</td>
<td>4</td>
<td>13.3</td>
</tr>
<tr>
<td>6/18-6/24</td>
<td>2</td>
<td>6.7</td>
</tr>
</tbody>
</table>

Average astigmatism ranged between -4 to -6 D.

<table>
<thead>
<tr>
<th>Graft size</th>
<th>No. of eyes</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.75</td>
<td>2</td>
<td>6.7</td>
</tr>
<tr>
<td>8.00</td>
<td>17</td>
<td>53.3</td>
</tr>
<tr>
<td>8.25</td>
<td>10</td>
<td>33.3</td>
</tr>
<tr>
<td>9.00</td>
<td>1</td>
<td>3.3</td>
</tr>
</tbody>
</table>
Keratometry: Manual and Sim K values were comparable but values were higher than the Subjective acceptance of the cylinder.

Orbscan Parameters  
a) Elevation: Higher anterior and posterior elevations were noted with corresponding lower BCVA as per Pearson's correlation coefficient.

b) Graft size of 8 to 8.50 mm was associated with higher zone irregularity both 3 mm and 5 mm. Smaller grafts had higher 5 mm irregularity though statistically not significant (P=0.92). Higher 3 mm and 5 mm irregularity was associated with lower BCVA.

c) Astigmatism: Oblate asymmetric bow tie was the commonest astigmatism type noted (50%).

d) Q value (asphericity)

<table>
<thead>
<tr>
<th>Q value</th>
<th>No. of eyes</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1.0 (parabolic)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>-1&lt;Q&lt;0 (prolate)</td>
<td>8</td>
<td>26.67</td>
</tr>
<tr>
<td>0(spherical)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>&gt;0 (oblate)</td>
<td>22</td>
<td>73.3</td>
</tr>
</tbody>
</table>

e) Contrast sensitivity was reduced at all spatial frequencies in all the patients by 32.25% which was done in photopic condition without glare. This did not have any correlation with any of the Orbscan and HCVA parameters.

f) VF-14 score of the study group was 91.42. More than 10 questions were answered by 66.66% of cases. All of them did not answer questions pertaining to sports and 37.04% had no response to questions related to driving.

DISCUSSION

Penetrating keratoplasty surgical techniques, equipment and postoperative care have advanced over years and have improved results and reduced intraoperative and postoperative complications, but patients still experience many types of visual problems. Patients are different regarding their perceptions, visual demands, and ability to cope with their visual status, and these differences cannot be fully ascertained using visual acuity levels alone. This study was done to ascertain visual quality after penetrating keratoplasty.

There was no statistically significant difference in final manifest astigmatism as per primary diagnosis. This was comparable to study done by Juan et. al, Spain comparing astigmatism in 60 eyes with different primary diagnosis. Manual K and Sim K astigmatism was comparable in all groups. Subjective acceptance yielded lowest value as compared to manual K and Sim K which was comparable with study by Achim Langenbucher et. al.
Oblique type of astigmatism and Asymmetric bowtie was commonest. This was comparable to study done by Q Touzeau et. al., FJO, Vol 24, No 2, March 2001 and Karabatsan et. al. Anterior and posterior elevation maps were abnormal which correspondingly reduced the BCVA. The Pearson’s positive correlation between 3 and 5 mm zone irregularity with BCVA log mar was statistically significant. Q Value showed oblate cornea, which did not affect BSCVA. This was comparable to Tuan, Kuang Mon Ashley et. al. (2006) study which showed changes in corneal asphericity after surgery had no significant correlation with visual acuity and contrast sensitivity.

The contrast sensitivity was reduced in all patients by 32% at all spatial frequencies; however this could not be co-related with other factors.

The VF-14 was a useful index to measure visual function improvement after PK, our study shows that, in general, patients’ visual function improves after corneal transplantation.

In conclusion the Orbscan, contrast sensitivity is an effective tool in determining the Quality of vision and VF14 in determining the quality of life. It has been noted that as the Anterior and posterior elevation increases the VA decreases. The 3 mm and 5 mm Zone Irregularity does contribute to decrease HDVA. The q factor contributes to the better visual quality.

Penetrating keratoplasty may provide excellent visual acuity as per Snellens chart, but it does not provide quality vision as good as normal eyes.

However, the present study also has some limitations that warrant consideration. In particular, the relatively small samples size of the study limited the extent of our statistical analyses.

REFERENCES
Bacterial keratitis is an important cause of blindness and preventable ocular morbidity worldwide. The severity of the corneal infection usually depends on the underlying condition of the cornea and the pathogenicity of the infecting bacteria. The spectrum of bacterial keratitis can also be influenced by geographic and climatic factors; this difference in profile has been noted between populations living in rural or city areas, in developed or in developing countries. This spectrum also tends to vary, though not significantly over time. Hence when we plan a strategy for diagnosis and treatment, it is essential to determine the etiological factors predisposing to ulceration and the pathogenic organisms that occur in a specific region. The aim of the study was to identify predisposing factors and to define clinical and microbiological characteristics of bacterial keratitis in a tertiary health care centre in state of Orissa.

MATERIALS AND METHODS
It is a retrospective study. The record of all patients with bacterial keratitis who were treated in our hospital during the period August 2008 to August 2010 were analysed. A bacterial keratitis was defined as a suppurative corneal infiltrate and overlying epithelial defect associated with presence of bacteria on corneal scraping and/or that was cured with antibiotics. We excluded patients with non-bacterial causes of keratitis, and those with no corneal scraping findings. The following data were collected by reviewing records of each patient: patient age and sex, and duration of the symptoms at the time of presentation. History and Examination were focused upon the following risk factors: corneal trauma, ocular surface diseases, contact lens wear, lagophthalmos, steroid eye drops and corneal foreign bodies or sutures as well as history of systemic diseases. The clinical findings, treatment received prior to presentation, visual acuity at the time of presentation were collected from medical records of the patients. Corneal infiltrates were classified to small (<5 mm), medium (5 mm-15mm) and large (>15mm) in size, and to central or peripheral. All patients had undergone thorough slit-lamp biomicroscopic examination and the findings recorded. After ocular examinations, corneal scrapings were taken under aseptic conditions from each affected eye under local anaesthesia. The microbiological evaluation for each patient included direct microscopy and culture of corneal scrapes. The corneal scraping was used to prepare a 10% potassium hydroxide (KOH) wet mount and to prepare smear for Gram staining and Giemsa staining. The corneal scrape material
was inoculated directly onto the surface of solid media such as sheep’s blood agar, chocolate agar, Sabouraud’s dextrose agar, potato dextrose agar, non-nutrient agar, brain heart infusion broth and thioglycollate medium.6

**Laboratory procedures:** All inoculated media were incubated aerobically. The inoculated Sabouraud’s dextrose agar was incubated at 27°C, examined daily, and discarded at 3 week if no growth was seen. The inoculated blood agar, chocolate agar, thioglycollate broth, brain heart infusion broth were incubated at 37°C, examined daily, and discarded at 7 days if growth was not seen. The inoculated non nutrient agar plates were incubated at 37°C after overlaying with Escherichia coli broth culture and were examined daily for the presence of Acanthamoeba species and discarded at 3 weeks, if there were no signs of growth.4,6,7

**RESULTS**

A total of 388 patients (396 eyes) were seen that were compatible with a diagnosis of bacterial keratitis during the study period of 24 months. The age of the patients ranged from 1 year to 82 years. The mean age of presentation of the patients during this period was 56 years. Out of the 388 patients studied, 229(59%) were males and 159(51%) patients were females. The male: female ratio was 1.4:1. Keratitis involved the left eye in 54.3% (215) of cases, and the right eye in 45.7% (181) of cases. 2% of the patients (8 cases) showed up with bilateral infection.

**Clinical correlation:** Predisposing risk factors; co-existing eye diseases were encountered in 62.8% (239) cases of bacterial keratitis. Thus they were the most common risk factor. Ocular injuries with vegetable matter, animal matter and others were the next most common predisposing factor accounting for 25% (95) cases. The use of contact lenses, ocular surgeries and use of topical steroids contributed to 7.2% (27) cases. Systemic diseases like diabetes mellitus, tuberculosis, leprosy and Steven Johnson syndrome accounted for the rest 5% (19) cases. Hypopyon was present in seven 15.6% (62) cases. A central infiltrate was seen in 237 (60%) cases. The infiltrate surface was less than 5 mm² in 90 eyes (22.8%), 5–15 mm² in 166 (42%), and greater than 15 mm² in 140 (35.2%). As the depth of the lesion were not measured for all patients, we didn’t include this parameter in this study. Seven patients had corneal perforation. Five cases ended with evisceration because of progression of the infection into unresolving endophthalmitis.

<table>
<thead>
<tr>
<th>Predisposing factors</th>
<th>Number of cases</th>
<th>Percentage(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Co-existing eye diseases</td>
<td>239</td>
<td>62.8</td>
</tr>
<tr>
<td>Ocular injuries</td>
<td>95</td>
<td>25</td>
</tr>
<tr>
<td>Contact lens use, topical steroids use, ocular surgeries</td>
<td>27</td>
<td>7.2</td>
</tr>
<tr>
<td>Systemic diseases</td>
<td>19</td>
<td>5</td>
</tr>
</tbody>
</table>
Microbiological consideration

Out of 396 cases, only 235 (61.8%) had bacteria identified from the corneal cultures. There were no obvious records about, whether antibiotic therapy had already been initiated or not, before hospital admission, so this factor was not included in the study. Gram positive bacteria were predominant (83% of all positive cultures) i.e in 235 cases. Gram negative bacteria (15%) were mostly Pseudomonas. Polybacterial infection was noted in five cases (2%). The percentage of Gram positive bacteria was 91% in the ocular surface disease group and 80% in the corneal trauma group. In CL wearers group, 63.3% of the corneal scrapings were positive. Thirty per cent of isolated bacteria were Gram negative.

DISCUSSION

The current study reports the epidemiology of bacterial keratitis applied to the general population presenting to a tertiary health care centre in Western Orissa. In our study, the average age of presentation was at an elderly age (mean age of 52 years), comparable with previous studies in South India. This is also in contrast to studies showing bimodality of age distribution in patients.

Bacterial keratitis is an ophthalmic emergency that is rare in the absence of predisposing factors. In our set up the most frequent predisposing factor for bacterial keratitis was found to be due to co-existing eye diseases similar to the reports in the study in South India. Some series showed use of contact lens as the most common risk factor.

The yield of culture from eye scraps to assess the aetiological diagnosis of bacterial keratitis in our study was around 61.8%. This was comparable with previous studies.

The microbiological profile of bacterial keratitis in this study showed Gram positive bacteria in 83% cases and Gram negative bacteria in 15% cases.

In conclusion although not a completely true representation of the population, our study does provide an insight into the spectrum of bacterial keratitis. It shows that co-existing ocular eye disease is the most important risk factor for bacterial keratitis. Gram positive bacteria are the commonest causative agents.

REFERENCES


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Glaucoma following Penetrating Keratoplasty: A Case Series

Dr. (Mrs.) Lavanya G. Rao, Dr. Ravi Chandra K, Dr. Vijaya Pai H., Dr. Sulatha V. Bhandary, Dr. Krishna Addoor Rao

Glaucoma following penetrating keratoplasty is a serious complication due to its frequency of occurrence, difficulty in diagnosis and management, risk of graft failure and irreversible visual loss due to optic nerve damage.

Problem statement: It is one of the most common causes for irreversible visual loss and the second leading cause for graft failure after rejection. Up to one-third of corneal graft failures is caused by a rise in intraocular pressure (IOP). The ensuing endothelial decompensation finally leads to permanent corneal graft opacification. There is general agreement that, unless the IOP is pre-operatively well under control, a penetrating keratoplasty should be avoided. The incidence of secondary glaucoma following penetrating keratoplasty varies from 9-31% in the early post-operative period and from 18-35% in the late post-operative period.

Purpose of this study is to report the incidence of post-operative glaucoma after penetrating keratoplasty and highlight the seriousness of this complication.

Retrospective case series of glaucoma following penetrating keratoplasty [27 eyes] done in our hospital during July 2007 to May 2011.

MATERIALS AND METHODS

IOP > 21 mm Hg [measured by Goldmann Applanation Tonometry [GAT] in immediate or late postoperative period with/without disc changes, was taken
as the sole criterion for diagnosing post-operative glaucoma. Follow up was after 1 week, 2 weekly for 2 months, monthly for 6 months, 2 monthly for 6 months

**RESULTS**

Study included 27 eyes of 20 male and 7 female patients who underwent penetrating keratoplasty during July 2007 – May 2011. Out of the 27 eyes, 8 had increase in IOP. Indication for graft was optical in 17 eyes and therapeutic in 10 eyes. 26 eyes were phakic and 1 eye was aphakic. Graft size and recipient bed size being 7.5 mm and 7 mm in 26 eyes, while 9 and 8.5 mm in 1 eye. Risk factors for raised IOP included aphakia, pre-existing angle anomaly, corneal ulcer, previous graft failure triple procedure, vitrectomy and steroid responsiveness. Out of the 8 eyes with post-op increased IOP, increase was within 2 weeks in 3 eyes, after 2 months in 3 eyes and after 3 months in 2 eyes. Out of these, 7 eyes were phakic and 1 aphakic. Indication was optical in 4 eyes and therapeutic in 4 eyes. 4 patients were steroid responders, 2 eyes had inflammatory reaction, 1 eye had pre-existing mesodermal angle anomaly and in 1 eye, it was third keratoplasty for previous graft failure. 5 patients were managed medically with good control of IOP while 3 patients had to undergo trabeculectomy, after which IOP was under control.

**DISCUSSION**

The important risk factors for glaucoma in patients undergoing Penetrating keratoplasty include aphakic and pseudophakic bullous keratopathy, mesodermal dysgenesis, irido-corneal-endothelial syndrome, preexisting glaucoma, perforated corneal ulcer, adherent leukoma, previous PKP, post-traumatic cases, combined Penetrating keratoplasty and intracapsular cataract extraction, and performance of vitrectomy during Penetrating keratoplasty.

The causes for elevated IOP in the early postoperative period are: postoperative inflammation, viscoelastic substances, wound leak with angle closure, hyphema, operative technique - tight suturing and long bites with compression of the angle, larger recipient bed with same size donor button, increased peripheral corneal thickness, pupillary block glaucoma, malignant glaucoma, preexisting peripheral anterior synechiae preexisting glaucoma and PKP in aphakic eyes secondary to mechanical angle collapse.

**The causes for elevated IOP in the late postoperative period are as follows:** PKP in aphakic eyes, PKP combined with cataract extraction, chronic angle-closure glaucoma, preexisting glaucoma, steroid-induced glaucoma, graft rejection with glaucoma, ghost cell glaucoma, misdirected aqueous or ciliary block (malignant) glaucoma, epithelial downgrowth, fibrous in growth.
The pathophysiology of glaucoma after PK is multifactorial; it may be related to distortion of the angle with collapse of the trabecular meshwork, suturing technique, postoperative inflammation, corticosteroid use, and peripheral anterior synechiae. The usual factors that contribute to postoperative glaucoma, such as preexisting glaucoma, postoperative inflammation, use of viscoelastic substances, and steroid-induced glaucoma, should be considered. Because of edema and inflammation, trabecular meshwork function is compromised. According to Olson and Kaufman, factors that contribute to angle distortion include tight suturing, long bites (more compressed tissue), larger trephine sizes, smaller recipient corneal diameter, and increased peripheral corneal thickness. Conversely, less tight wounds, smaller trephine sizes, donor corneas larger than the recipient, thinner recipient corneas, and larger overall corneal diameter tend to alleviate the angle distortion.

Both acute and chronic IOP elevation after PK are at times very difficult to control. Medical therapy should be tried first, because every surgical procedure can further endanger the survival of the graft.

Beta blockers are accepted as the drugs of first choice and can be used in combination. Miotics are better avoided in eyes because they increase post-op inflammation. Laser modalities [Argon, Nd:YAG or Diode] include laser trabeculoplasty, laser iridotomy and cyclophotocoagulation. The last option is considered only in cases of advanced glaucoma with no hope of vision.

Surgical options include filtering procedures with or without antimetabolites and aqueous drainage devices [success rate 70%]. However, more complex procedures tend to increase the rate of graft failures due to a more severe postoperative inflammatory reaction.

Improvements in the surgical technique of PK that help in prevention of glaucoma are: a smaller graft having lesser influence on the peripheral cornea and angle, sutures that try to re-establish a continuity of descemet’s membrane, maintenance of AC depth during surgery preventing PAS – water tight suturing and use of viscoelastic materials, routine peripheral iridectomy to avoid post-op papillary block, post-op topical steroids and cycloplegics to suppress inflammation.

In conclusion Incidence of glaucoma in our study was around 30%, which correlated with many studies. IOP assessment during each post-op follow up is crucial to diagnose and manage this important sight-threatening complication. Taking care of possible risk factors, improving the surgical techniques and closely following the patient can significantly increase the overall success rate. In other words, the surgeon caution before and after the surgery is the key to success to avoid this complication.
Cornea Free Papers

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DSEK in CHED: To Strip or not to Strip The Descemet’s Membrane? – A Comparative Outcome

Dr. Jatin N Ashar, Dr. Muralidhar Ramappa, Dr. Sunita Chaurasia

Descemet stripping endothelial keratoplasty (DSEK) has been recently described as an alternative to penetrating keratoplasty for management of congenital hereditary endothelial dystrophy (CHED).1,2,3 Few modifications in surgical procedure may help in successful completion of DSEK in CHED. These include the use of Trypan blue4 dye to stain the DM, use of Chandelier light pipe5 to enhance visualization or perform endothelial keratoplasty without stripping the DM.1 There are a few studies where EK has been successfully performed without removal of DM in cases of pseudophakic bullous keratopathy,6 failed graft7 and corneal decompensation following argon laser iridotomy8 and in few cases of CHED.1

Herein we present the comparative evaluation of outcomes of non Descemet stripping endothelial keratoplasty with Descemet stripping endothelial keratoplasty in patients with CHED.

MATERIALS AND METHODS

Ours is a retrospective interventional case series of 6 eyes of 6 patients with congenital hereditary endothelial dysfunction. Patients were divided into two groups, group 1 patients underwent a standard DSEK while group 2 patients underwent a non-Descemet stripping endothelial keratoplasty (n-DSEK). The
donor details, surgical technique and the intraoperative difficulties were evaluated. The patients were followed up in the post operative period on day 1, 1 week, every monthly for 3 months and then every 3 monthly. At each visit they were evaluated for the vision including lenticule status, corneal clarity and any complications were assessed. Since refraction stabilizes by 3 months in cases of DSEK, we compared the 2 groups till 3 months of follow up.

**RESULTS**

Table 1 summarizes the results.

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Group 1: Standard DSEK (n=3)</th>
<th>Group 2: n-DSEK (n=3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age at surgery</td>
<td>5.6±1.52 years</td>
<td>5.6±0.57 years</td>
</tr>
<tr>
<td>Sex ratio</td>
<td>M:F 2:1</td>
<td>M:F 1:2</td>
</tr>
<tr>
<td>Preoperative visual acuity</td>
<td>0.08±0.06</td>
<td>0.05±0</td>
</tr>
<tr>
<td>1 month visual acuity (Snellen’s decimal units)</td>
<td>0.13±0.10</td>
<td>0.15±0.12</td>
</tr>
<tr>
<td>3 month visual acuity (Snellen’s decimal units)</td>
<td>0.13±0.10</td>
<td>0.13±0.10</td>
</tr>
<tr>
<td>Refraction patient 1</td>
<td>7.5 DS / -1 DC @90</td>
<td>-2.5 DS /-1.75 DC@ 95</td>
</tr>
<tr>
<td>Refraction patient 2</td>
<td>-1 DS / -1DC @90</td>
<td>4DS</td>
</tr>
</tbody>
</table>

**DISCUSSION**

We postulate the following advantages of not stripping of DM in cases of CHED: 1. Reduced surgical time, and hence a decreased time under general anesthesia 2. Avoiding any inadvertent injury to the clear lens 3. Prevention of scarring at the interface due to undisturbed posterior stromal fibers 4. Avoiding trabecular meshwork disturbance due to stripping of DM.

In conclusion, the results of our small comparative case series suggest that the short term outcomes after n-DSEK and DSEK are comparable for CHED. However, longer follow up with more patients may be needed to improve the understanding of behavior of n-DSEK in CHED.

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**Alcohol Delamination with Phototherapeutic Keratectomy – A Novel Method in The Treatment of Recurrent Corneal Erosions**

**Dr. Remya Mreen Paulose, Dr. Aneeta Jabbar**

Recurrent corneal erosion (RCE) is characterised by episodes of spontaneous breakdown of the corneal epithelium due to defective adhesion to the basement membrane. Recurrent corneal erosion syndrome (RCES) is classified as either dystrophic (dystrophic-RCES) where it occurs associated with an anterior corneal dystrophy, or non-dystrophic (ndRCES) where it occurs following superficial corneal trauma (post-traumatic RCES).

A variety of treatments are available for RCES, reflecting the lack of total efficacy of any single treatment. Options includes bandage contact lens, epithelial debridement, superficial keratectomy with a diamond burr, anterior stromal puncture, and Nd:YAG laser have been used with varying success. Several authors have reported the use of excimer phototherapeutic keratectomy (PTK) for this condition. Reported success rates for this treatment have varied from 69% to 86%. Recurrence rates are likely to be higher when PTK is used for dystrophic RCES. Delamination of the corneal epithelium with alcohol has become a valuable alternative. Electron microscopic examination of epithelium removed with ALD shown separation of the epithelium from the stroma at the level of the lamina lucida, with apparently intact hemidesmosomes on the basal epithelial surface. Although this method has proven advantages, recurrence rate ranges to 15%.

There is little in the literature regarding any combined surgical modalities for treatment of recurrent corneal erosion and the individual treatment regimens have proven recurrences.
Aim of this study is To investigate the safety and efficacy of alcohol delamination with Phototherapeutic Keratectomy in recurrent corneal erosion.

**MATERIALS AND METHODS**

This is a prospective study done in 22 eyes of 22 patients with recurrent corneal erosions who underwent alcohol delamination with phototherapeutic keratectomy in a tertiary eye care centre in south India. Duration of study was from January 2009- January 2011.

**Inclusion criteria:** Recurrent corneal erosion treated with lubricants/along with BCL for atleast 3 months remaining symptomatic, Etiology-trauma, idiopathic and cogans dystrophy, Minimum 1 year follow up, Pachymetry > 400 µm.

**Exclusion criteria:** Recurrent corneal erosions due corneal dystrophies other than cogan’s, other comorbidities.

**Preoperative evaluation**

Uncorrected visual acuity, best corrected visual acuity, refractive error, slit lamp biomicroscopy, dilated fundus examination, keratometry, corneal topography, pachymetry, corneal sensation, Schirmer’s test. Ethical approval was obtained. Consent was taken from each patient describing the surgical procedure and the probable risks involved.

**Steps of surgery**

Under topical anaesthesia using 4%. A circular well sufficient to encompass the area of erosions was placed onto the cornea and a few drops of 20% alcohol was placed inside the well and left for 30s. The alcohol was then drained with a surgical sponge. Corneal epithelium was removed from the treated area as a single sheet. Phototherapeutic keratectomy was done using excimer laser in PTK mode to a depth of 5-7 µm. Bandage contact lens was placed after the procedure. Patients were followed up at first post-op day, fourth post-op day, 1 week, 3 weeks, one month and every three months till 1 year. They were given topical antibiotics and tear substitutes. After complete epithelisation BCL was removed and topical steroids were started.

Primary outcome variables were resolution of symptoms and total epithelial healing time. Secondary variables included postoperative hyperopic shift if any , duration of symptoms, aetiology and final visual outcome.

**RESULTS**

Out of the 22 patients enrolled in the study 15(68.18%) patients were females and 7 (31.81%) patients were males. Mean age of patients was 34 years ± 9.3 years. Mean duration of symptoms was 7 months (range -5 months to 14 months).
Table 1: Baseline patient characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age (yrs)</td>
<td>34 ± 9.3 (range 23-44 years)</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>7</td>
<td>(31.82%)</td>
</tr>
<tr>
<td>Female</td>
<td>15</td>
<td>(68.18%)</td>
</tr>
<tr>
<td>Etiology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Traumatic</td>
<td>16</td>
<td>(72.72%)</td>
</tr>
<tr>
<td>Dystrophy</td>
<td>4</td>
<td>(18.18%)</td>
</tr>
<tr>
<td>Idiopathic</td>
<td>2</td>
<td>(9.09%)</td>
</tr>
</tbody>
</table>

On follow up after one year, 21 patients had resolution of their symptoms, although 2 of these patients required further topical lubricants for attaining this. Only 1 patient had recurrence of symptoms even with lubricants.

Table 2: Resolution of symptoms

<table>
<thead>
<tr>
<th>Resolution of symptoms</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete</td>
<td>19</td>
<td>86.36%</td>
</tr>
<tr>
<td>Requiring topical lubricants</td>
<td>2</td>
<td>9.1%</td>
</tr>
<tr>
<td>Recurrence</td>
<td>1</td>
<td>4.5%</td>
</tr>
</tbody>
</table>

1 patient who had recurrence belonged to the corneal dystrophy group and the recurrence occurred after 5 months of the procedure.

Mean epithelial healing time was 6 days (range –3 days –2 weeks). More healing time was seen after the procedure in dystrophic corneal erosions reflecting the pathology.

In all the patients throughout the follow up period visual acuity was maintained. The improvement in visual acuity postoperatively was found to be statistically significant with a P value of 0.029.

There were no major complication like epithelial haze, scarring seen in any of the patients intraoperatively or during follow up. There was no case of any infection or endophthalmitis. Postoperative pain was relieved with therapeutic contact lenses and topical NSAIDS.

DISCUSSION

Both PTK and alcohol delamination have been used singly in the treatment of recurrent corneal erosion. They have proven recurrences. Inspite of this, literature is lacking regarding the use of any combined procedures for the treatment of recurrent corneal erosion. Based on the experience of treating recurrent corneal erosion in this series of patients, combined procedure alcohol delamination with phototherapeutic keratectomy offers a safe and more effective form of treatment for recurrent corneal erosion. Resolution
was attained in 21 patients (95.46%) with 2 patients requiring further topical lubricant drops. Brart et al in their study on the efficacy of PTK alone in the treatment of recurrent corneal erosion has reported a success rate of 86.6%.

Out of the 22 patients enrolled in the study the recurrence was only 4.5%. ALD enables efficient removal of the epithelium with an almost complete preservation of the lamina densa in traumatic RCE. In RCE due to corneal dystrophy the epithelium separates from the stroma below the basal lamina and may reflect the pathology of the condition. Hence it added to the efficacy of PTK by getting the correct cleavage plane and ablation depth. PTK alone has a proven recurrence rate of 16% while alcohol delamination alone has 15% recurrence. Other treatment modalities like bandage contact lens, epithelial debridement, superficial keratectomy with a diamond burr, anterior stromal puncture, and Nd:YAG laser also show similar outcomes.

In the study group 16 out of 22 had history of previous trauma (post-traumatic RCES) to the affected eye, 2 had no predisposing factors (idiopathic RCES), and 4 were due to corneal dystrophy. The commonest etiology found was due to trauma (72.2%), which is comparable to the study conducted by Cavanaugh et al. In all patients who underwent the combined procedure vision was maintained throughout the period. The improvement in visual acuity in this group was found to be statistically significant. This is due to the elimination of irregular epithelial surface. There was no significant hyperopic shift in any of the cases, that was due to the shallow depth of ablation used. There was no case of any drop in vision in the 1 year follow up. There were no complications like epithelial haze, scarring, and persistent epithelial defect following the combined treatment in our patients. This is likely to be due to the very shallow depth of ablation. Using a PTK it is possible to treat affected areas that encroach on the visual axis with excellent visual rehabilitation. This is in contrast with other forms of interventional treatment—notably, anterior stromal puncture where postoperative scarring may limit treatment of the central cornea.

Limitations of our study include the small number of patients, short term follow up and lack of comparison group.

In conclusion we have found the combined procedure of alcohol delamination with Phototherapeutic Keratectomy to be safe and effective in the management of recurrent corneal erosion.

REFERENCES


In Chronic Dry Eyes, PRK & LASIK

Eyemist Forte
HPMC 0.3% + Dextran (70) 0.1% + Glycerin 0.2%

Preserved with Sodium Perborate

Lubrication
Retention
Osmoprotection
Trinity

No blurring of vision

Longer Retention & Excellent Comfort

Avesta
To Study Pattern, Management and Recurrence of OSSN in Histopathologically Proven Lesions

Dr. Rohit Bang, Dr. Manasi Jadhav, Dr. Sushma Verma

Ocular surface squamous neoplasia (OSSN) is a distinct clinical entity presenting as a spectrum from simple dysplasia to invasive carcinoma of ocular surface.

MATERIALS AND METHODS

95 eyes of 95 patients were studied in the time period from May 2007-May 2011. Patients were examined on slit lamp, mass lesion dimensions were measured with the help of slit beam, and extent of lesion was studied with Rose Bengal stain and systemic examination was done to rule out lymph node involvement. An impression cytology of the lesion was done and blood sample was taken for HIV antibodies.

Surgical Technique: All patients were subjected to excision biopsy with MMC 0.04% applied for 1 min on resected healthy subconjunctival edges followed by cryo application to conjunctival margins and absolute alcohol applied to involved corneal surface. All biopsy samples were sent for histopathology examination. The area of bare sclera was covered by AMT and secured with fibrin glue. Post-operatively patients were given low potency topical steroids, topical antibiotic, lubricants and MMC 0.04% drops one week on and one week off cycle, 2 cycles with punctal occlusion. Patients were followed up at 1 wk., 1 month, 6 months and then yearly thereafter.

RESULTS

Of the 95 patients, 48 had CIN 3 and 47 had invasive SCC. Male to female patients ratio was found to be 2:1.1. The ratio for site of involvement was nasal: temporal: 3:1. Nodular variant was seen in 48% cases, diffuse in 31%, gelatinous 12%, leukoplakic 8% of total cases 11.5% recurrences were found in our study in three years follow-up with average time of recurrence being 19.9 months and more common in diffuse lesions. None of our patients tested positive for HIV antibodies.

DISCUSSION

OSSN presents as a spectrum from simple dysplasia to carcinoma in situ to invasive squamous cell carcinoma involving conjunctiva and cornea. It forms about 14% of oculo-orbital tumors. Tumour is more common in older males.
### Table 1: Clinical Data

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Number Age (Yrs)</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>47.2</td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>17-85</td>
<td></td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
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<tr>
<td>Male</td>
<td>60</td>
<td>63.16 %</td>
</tr>
<tr>
<td>Female</td>
<td>35</td>
<td>36.84 %</td>
</tr>
<tr>
<td><strong>Type of OSSN</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cin Iii</td>
<td>48</td>
<td>50.53</td>
</tr>
<tr>
<td>Scc</td>
<td>47</td>
<td>49.47</td>
</tr>
<tr>
<td><strong>Clinical Type</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nodular</td>
<td>47</td>
<td>48</td>
</tr>
<tr>
<td>Gelatinous</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>Diffuse</td>
<td>30</td>
<td>31</td>
</tr>
<tr>
<td>Leukoplakic</td>
<td>7</td>
<td>8</td>
</tr>
</tbody>
</table>

### Table 2: Recurrence Rate

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Number</th>
<th>Percent</th>
<th>Time (Months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cin Iii</td>
<td>5/48</td>
<td>10.42</td>
<td>27.3</td>
</tr>
<tr>
<td>Scc</td>
<td>6/47</td>
<td>12.77</td>
<td>16.8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>11/95</td>
<td>11.58</td>
<td>19.9</td>
</tr>
</tbody>
</table>
Average age at presentation is 56 yrs in literature, while in our study the average age of presentation was 47.2 yrs. Clinically they present as pearly grey to reddish gray slightly elevated, sharply demarcated lesion usually at nasal or temporal limbus with sentinel vessel. The gelatinous type is said to be common in literature but we found the nodular variant more common. Histopathologically, lesions are classified as CIN I dysplasia in lower one third of conjunctival epithelium, CIN II dysplasia up to middle third, CIN III severe dysplasia up to upper one third. In invasive SCC dysplastic cells penetrate basement membrane and extend into stroma. Dissection of all abnormal tissue with wide surgical margins of 2-3 mm ensures removal of majority of lesions. Recurrence rate following simple excision ranges from 15-52 % (avg 30%). When cryotherapy is applied to healthy conjunctiva margins after excision, recurrence rate lowers to around 7-22% (avg 12%). Excision, cryotherapy, and mitomycin C application reduces recurrence rate to around 9%. It was 11.5% in our study.

In conclusion OSSN is one of the common ocular malignancies seen in middle aged population, nodular variant being more common and excision biopsy with cryotherapy with mitomycin-C application reduces the recurrence rate drastically and can be used as standard modality of treatment in the best interest of our patients.

Intracameral Voriconazole in The Management of Fungal Keratitis with Endothelial Plaque

Dr. Anjana Devi R., Dr. Anita Raghavan

Fungal keratitis is a significant cause of ocular morbidity in India. Fungi can penetrate the intact Descemet membrane and enter the anterior chamber, resulting in endothelial plaque and hypopyon, which is difficult to treat with antifungal agents because of their poor ocular penetration or bioavailability, and toxicity.¹ Intracameral Amphotericin-B has been used before in deep fungal keratitis²,³ but it is associated with increased anterior chamber reaction and the risk of potential injury to the lens and toxicity to the corneal endothelium.⁴ Intrastromal Voriconazole has been reported to be safe and effective in deep recalcitrant fungal keratitis.⁵,⁶ Intracameral voriconazole injection is reported to be a safe and effective treatment for fungal endophthalmitis contiguously spreading from keratitis⁷ and in intracameral extension following penetrating keratoplasty for fungal keratitis.⁸ The purpose of our study was to find out the role of intracameral injection of Voriconazole in fungal keratitis with endothelial plaque.
MATERIALS AND METHODS
This was a retrospective study including all the patients with fungal keratitis who were having deep stromal infiltrates and endothelial plaque and were given intracameral voriconazole during the period of December 2010 to May 2011. All the patients were referred to our centre from peripheral hospitals. Proper history was obtained including the cause of the ulcer, treatment given outside and the duration of the treatment. Complete ocular examination was performed including vision, slit lamp examination, ultrasonography to evaluate the posterior segment, digital pressure of the eye and lacrimal sac syringing test. Corneal ulcer scraping was done and sent for Gram’s staining, KOH wet mount preparation and culture in Blood agar, Chocolate agar and Sabouraud’s Potato Dextrose agar. All the cases showed fungal filaments on KOH and Gram’s staining.

All the patients were started on 5% Natamycin eye drops half hourly, 1% Voriconazole eye drops half hourly and T. Ketoconazole 200 mg BD. The decision for intracameral Voriconazole was taken if the ulcer was not responding to topical antifungals. 100 microgram/ 0.1 ml of injection Voriconazole was given intracameral under sterile precautions. Subsequent injections were given if no response was found after the initial injection ,after a minimum of 48 hours duration. Injections were not repeated after signs of healing started appearing. Topical and systemic antifungals were continued even after starting intracameral injections.

If the patient was showing signs of worsening despite multiple injections or if the ulcer or endothelial plaque was rapidly worsening Penetrating Keratoplasty was done.

Method of Preparation
200mg injection Voriconazole in powder form was reconstituted in 19 ml. of sterile water. 0.1 ml. of this solution was added to 0.9 ml. of sterile water to obtain the dose of 100 microgram per 0.1 ml. 0.1 ml. solution from this was injected intracameraly under sterile precautions.

RESULTS
12 eyes of 12 patients with fungal keratitis with endothelial plaque were selected. Age of the patients ranged from 11 years to 79 years (mean age 50.3 years).
2 patients gave history of injury with inorganic material, 7 patients with organic material and 3 patients were not aware of the cause.
Out of 12 cases, only 5 cases showed fungal growth on culture. 1 was Fusarium species, 1 was Aspergillus niger. 3 were unidentified.
Preinjection duration of medical treatment given was 46.61 days (Range - 5 days to 60 days). The number of intracameral injections given ranged from 1 to 12 (average – 3.33). Duration of the treatment after the injections started ranged from 11 to 90 days (average – 35.33 days).

8 cases healed by scarring and 4 cases which did not respond to treatment underwent keratoplasty.

All the cases which healed by scarring got 3 or more intracameral injections of Voriconazole. The cases which went for TKP got 1 or 2 intracameral injections. The number of injections were significantly correlated with scarring (p value 0.0036). Statistical correlation was done using Mann Whitney signed rank test using SPSS software 17.0.

Duration of the treatment was longer in healed cases, ranging from 23 to 90 days. The correlation was found to be statistically significant (P value 0.0043). In 4 cases where medical treatment failed, duration of the treatment ranged from 11 to 18 days.

**DISCUSSION**

In fungal keratitis surgery may need to be performed on cases unresponsive to medical therapy or where serious complications are likely to occur. According to an analysis made of 49 patients with deep stromal keratitis reported in the
literature, it was concluded that almost 70% of patients with Fusarium keratitis with deep lesions do not respond to medical therapy alone and some form of surgical intervention is necessary.\(^9\)

In our study where deep keratitis was treated with intracameral injection of Voriconazole, surgical intervention was required only in 33.3% cases. All the patients who were already treated with topical natamycin and topical voriconazole were not showing response to the medical treatment. Healing was significantly correlated with the number of intracameral injections given and the duration of treatment.

In conclusion Intracameral Voriconazole was found to be safe and effective in the treatment of fungal keratitis with endothelial plaque in our study. Giving more number of injections and waiting for a longer time before deciding about Therapeutic Keratoplasty may be a better option to bring about healing in such cases.

REFERENCES

Agreement in Measuring Depth of Demarcation Line after Corneal Collagen Cross-Linking using In vivo Confocal Microscopy and Anterior Segment Optical Coherence Tomography

Dr. Koushik R Sargod, Dr. Rohit Shetty, Dr. Rajesh S Kumar, Dr. Harsha Nagaraju

To evaluate the depth of the stromal demarcation line in vivo after corneal collagen cross-linking (CXL) in Asian Indian eyes with keratoconus using in vivo confocal microscopy (IVCM) and anterior segment optical coherence tomography (ASOCT).

MATERIALS AND METHODS

In this prospective observational study, consecutive patients with keratoconus who underwent CXL were examined with a slit lamp and imaged using IVCM (Heidelberg Retina Tomograph II; Heidelberg, Germany) and ASOCT (Source swept Fourier domain OCT; Tomey, Japan) at one week and 3 months after the procedure.

Collagen cross linking with riboflavin:

- Performed under topical anesthesia.
- Sterile condition in Operating room.
- Epithelial debridement
- Crisscross pattern
- Scraper
- 0.1% Riboflavin in 20% dextran every 3 min/ 30 min.
- UV-A: 365 nm, 3mW/cm2 for 30 minutes with riboflavin every 5 min.
- Wash thoroughly with RL.
- BCL applied.

Imaging

All patients who underwent CXL were examined under slit lamp for the presence of demarcation line. This was followed by IVCM and ASOCT.

Demarcation line (DL) was defined on IVCM as increased density of hyper-refractile extracellular matrix and on ASOCT as a hyper-reflective stromal line.

RESULTS

Twenty-three eyes (15 subjects) with keratoconus were evaluated.
The appearance and mean depth of DL in slit lamp, IVCM and ASOCT is given below:

<table>
<thead>
<tr>
<th></th>
<th>DL at 1 week</th>
<th>DL at 3 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slit lamp</td>
<td>78.3%</td>
<td>30.4%</td>
</tr>
<tr>
<td>IVCM</td>
<td>100%</td>
<td>69.5%</td>
</tr>
<tr>
<td>ASOCT</td>
<td>100%</td>
<td>65.3%</td>
</tr>
</tbody>
</table>

**Mean Depth (Range)**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>IVCM</td>
<td>320.3μ (301.8 - 338.8)</td>
</tr>
<tr>
<td>ASOCT</td>
<td>294.7μ (277.8-311.5)</td>
</tr>
</tbody>
</table>

Bland Altman (BA) plots: demonstrated a systematic difference between the two devices, with the ASOCT underestimating the depth of the line when compared to IVCM (95% limits of agreement, -90.5 to 39.2).

In conclusion although both IVCM and ASOCT appear adept at demonstrating the demarcation line following CXL, differences in depth measurement obtained from the devices indicate that these measurements cannot be used interchangeably.

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**Intra-op Pachymetry Variation in Collagen Cross Linking (CXL) with Isotonic and Hypotonic Riboflavin**

**Dr. Mukesh Taneja, Dr. Kunjal Sejpal, Dr. Pravin Krishna, Dr. Somasheila Murthy**

Corneal collagen cross-linking (CXL) with riboflavin and ultraviolet A (UVA) irradiation is now an accepted procedure used worldwide for the stabilization of different types of corneal ectatic disorders. This is achieved by the augmentation of the mechanical rigidity of the cornea by inducing cross-links at the corneal stroma. Spoerl et. al. proposed a corneal preoperative thickness of 400 μm as a minimum safety limit to avoid endothelium, lens, and retinal damage. In many advanced cases of Keratoconus, the corneal thickness falls below 400 μm thereby limiting the role of CXL procedure in these cases. However Hafezi et. al³ and Raiskup et. al⁴ have reported the use of hypo osmolar Riboflavin solution in cases of Keratoconus with thin cornea
with good results. However, Kymionis et al. had raised a concern about the intraoperative pachymetric variations in patients undergoing CXL procedure.\textsuperscript{5} This prospective study evaluated the intraoperative pachymetric variations during corneal CXL with the use of isoosmolar and hypo osmolar riboflavin and UVA irradiation in keratoconic patients and correlated the outcomes in terms of safety profile of the procedure.

**MATERIALS AND METHODS**

Eight eyes of 8 patients underwent CXL procedure with Isoosmolar riboflavin (Group A). Mean patient age was 17.6 ±3.5 yrs. (range, 14-24 yrs). Whereas, in four eyes of 4 patients, hypo osmolar riboflavin was used (Group B). Mean patient age was 20.8 ±7.3 yrs. (range 13-28 yrs).

Intraoperative central corneal thickness (CCT) measurements using ultrasound pachymetry were performed during the procedure. Measurements were obtained before and after epithelial removal, after riboflavin drops instillation for 15 minutes and at 30 minutes and every 15 minutes during UV A irradiation (total 6 point intervals). All the patients were followed up over a period of at least six months and adverse events, if any, were noted.

**RESULTS**

In group A, mean preoperative CCT was 449.4 ± 28.2 μm (range, 418-495μm) and 302.2 ±29.7μm (range, 248-343μm) at the end of CXL procedure. Total intra-operative pachymetry variation was 160 ± 31.6μ in group A. (Table-1).

<table>
<thead>
<tr>
<th>Patient No.</th>
<th>Age</th>
<th>Eye</th>
<th>Pre-epithelial</th>
<th>15 min</th>
<th>30 min</th>
<th>45 min</th>
<th>1 hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>19</td>
<td>OS</td>
<td>429</td>
<td>395</td>
<td>336</td>
<td>289</td>
<td>258</td>
</tr>
<tr>
<td>2.</td>
<td>14</td>
<td>OS</td>
<td>424</td>
<td>403</td>
<td>421</td>
<td>386</td>
<td>332</td>
</tr>
<tr>
<td>3.</td>
<td>21</td>
<td>OD</td>
<td>469</td>
<td>407</td>
<td>383</td>
<td>330</td>
<td>326</td>
</tr>
<tr>
<td>4.</td>
<td>18</td>
<td>OS</td>
<td>476</td>
<td>433</td>
<td>370</td>
<td>326</td>
<td>294</td>
</tr>
<tr>
<td>5.</td>
<td>15</td>
<td>OD</td>
<td>495</td>
<td>431</td>
<td>392</td>
<td>328</td>
<td>326</td>
</tr>
<tr>
<td>6.</td>
<td>15</td>
<td>OS</td>
<td>418</td>
<td>334</td>
<td>351</td>
<td>277</td>
<td>266</td>
</tr>
<tr>
<td>7.</td>
<td>15</td>
<td>OD</td>
<td>431</td>
<td>352</td>
<td>346</td>
<td>298</td>
<td>315</td>
</tr>
<tr>
<td>8.</td>
<td>24</td>
<td>OD</td>
<td>453</td>
<td>395</td>
<td>360</td>
<td>363</td>
<td>244</td>
</tr>
</tbody>
</table>

In group B, mean preoperative CCT was 417.3 ± 13.6 μm (range, 400-432μm) and 291.3 ±24.9μm (range, 272-327μm) at the end of CXL procedure. Total intra-operative pachymetry variation was 143 ± 26.2μm in group B. (Table 2).
In one patient of group A, transient endothelial oedema was noticed which resolved over a period of one week. In one patient each in group A and B, contact lens related peripheral ulcer (CLPU) was noticed postoperatively which resolved with medications in both cases. A mean endothelial cell count was recorded as 2562/sq mm preoperatively and 2472/ sq mm one month postoperatively in group A and 2795 /sq mm preoperatively and 2751/ sq mm one month postoperatively in group B. Both the groups did not show any significant decrease in endothelial cell counts on specular microscopy after one month of CXL procedure. All the patients in both the groups showed stability of keratoconus at the end of six months of CXL procedure.

**DISCUSSION**

It has been seen in the animal studies that CXL affects anterior corneal stroma up to a constant depth of 300 microns. Riboflavin produces a shielding effect, absorbing 95% of the UV irradiation. Thus the UV irradiance that reaches the corneal endothelium is 0.06 mw/cm², which is well below UV irradiance threshold i.e., 0.3w/cm² for corneal endothelium damage. Hypo osmolar Riboflavin, by increasing the corneal thickness during CXL procedure, is supposed to keep the corneal endothelium well protected from the effect of UV irradiance thus making this procedure safe in patients with cornea < 400 microns thick and also hypothetically, isoosmolar Riboflavin in Dextran is not supposed to cause any alteration in corneal thickness during CXL procedure.

However significant intraoperative variation has been reported earlier by Kymionis et. al, who reported a mean preoperative corneal thickness of 485 μm which decreased to 340 μm after 30 minutes of riboflavin exposure. Tahzib et. al⁶ have claimed that this variation can be avoided if eye speculum is not used during the riboflavin drops instillation and the same procedure was used by Raiskup et. al in their study of CXL in thin keratoconic corneas.

However, we saw a significant decrease in central corneal thickness in both the isoosmolar and hypo osmolar group during the riboflavin instillation even when no eye speculum was used and also during irradiation with UV-A light. This raises safety and efficiency concerns about the CXL procedure as

### Table 2: Intraoperative Pachymetry variation in Group B (CXL with Hypoosmolar Riboflavin)

<table>
<thead>
<tr>
<th>Patient No.</th>
<th>Age</th>
<th>Eye</th>
<th>Pre-op</th>
<th>Epith removal</th>
<th>15 min</th>
<th>30 min</th>
<th>45 min</th>
<th>1 hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>26</td>
<td>OS</td>
<td>400</td>
<td>349</td>
<td>364</td>
<td>382</td>
<td>237</td>
<td>272</td>
</tr>
<tr>
<td>2.</td>
<td>13</td>
<td>OS</td>
<td>422</td>
<td>376</td>
<td>358</td>
<td>347</td>
<td>316</td>
<td>327</td>
</tr>
<tr>
<td>3.</td>
<td>16</td>
<td>OS</td>
<td>415</td>
<td>391</td>
<td>355</td>
<td>403</td>
<td>255</td>
<td>277</td>
</tr>
<tr>
<td>4.</td>
<td>28</td>
<td>OS</td>
<td>432</td>
<td>364</td>
<td>381</td>
<td>377</td>
<td>333</td>
<td>289</td>
</tr>
</tbody>
</table>
the significant decrease in central corneal thickness may increase the UV irradiance reaching up to the corneal endothelium which may go beyond the safety threshold of 0.3 mW/sq. cm.

In conclusion there is a wide range of intraoperative pachymetry variation seen in both isoosmolar and hypoosmolar groups during CXL procedure which goes below the critical 320 μm at various time points. Even though we did not see any serious adverse events in this series, there exists a need to evolve better protocols for the CXL procedure.

REFERENCES

Correlation of HbA1c Levels and Central Corneal Thickness in Diabetic Patients

Dr. Kalpana Suresh, Dr. Meghana Koorapati, Dr. Tanvi Khanna, Dr. Ramya Ravindran, Dr. Aravinda Bachu

Diabetes mellitus (DM) is a systemic disease that alters the major metabolic pathway in the human body and destroys major organ systems. Diabetic retinopathy is the most common and investigated ocular complication. However, morphologic and functional changes in the cornea have been studied less frequently in diabetic eyes.1-7 Stromal and subbasal nerve abnormalities,1 low endothelial cell density and hexagonality2, reduction in corneal sensitivity,3 increased corneal autofluorescence4, and recurrent corneal erosions5 are among the corneal changes observed in diabetic patients. Corneal thickness has also been evaluated in previous studies.2,3,6,8,9 However, the effects of HbA1C level on central corneal thickness (CCT) have not so far
been studied. In this prospective study, 50 patients with DM and 50 controls were compared in terms of CCT, assessed by ultrasound pachymetry. The effects of the control of DM, the mean and current hemoglobin A1c (HbA1C) level on CCT were investigated. ANOVA and multivariate regression were used for statistical analysis. 

Aim of this study is to evaluate the central corneal thickness (CCT) in diabetics and determine its association with diabetes mellitus related variables.

MATERIALS AND METHODS

Our study population comprised 50 diabetics and 50 control healthy subjects. All study subjects underwent a routine ophthalmologic examination. Patients who had previous intraocular surgery, corneal scarring, active infection, corneal dystrophies, degenerations ocular trauma, intraocular inflammation, and glaucoma, and who wore contact lenses were excluded. Those who had received laser photocoagulation within less than 1 month were also excluded. CCT was measured using TOPCON SP2000p. FBS, PPBS, HbA1C blood investigations were done. HbA1C investigated with BIORAD 10 equipment. Diabetic patients were classified according to HbA1C levels (over or under 7%). The CCT values were obtained on the first visit when patient had high HbA1C values and the second follow up when the HbA1C values were controlled.

RESULTS

The analysis of covariance with age as the covariant indicated that the DM group had significantly increased CCT (mean 0.513 ± SD =0.058) (P=0.000) compared with the control group (P=0.461). A multivariate regression model evaluating the effects of age, duration of DM, the mean, current HBA1C levels (Mean 5.803,SD-1.4796) on CCT was statistically significant (P=0.002). 75.5% patients had HbA1C >7 gm%, and 24.5% had HbA1C<7 gm%.

In conclusion several studies have evaluated corneal thickness in diabetic eyes. Some studies included only type I diabetics and some investigated both type I and II diabetics. Patients with type II diabetics were studied and it was found that type II diabetics even without retinopathy had thicker central corneas than non-diabetic subjects. The reason why corneal thickness increases in diabetics is that although the cause is obscure, it is postulated that endothelial pump function disturbance due to reduction of Na+/K+ ATPase activity results in an increase in stromal hydration. The central cornea might have increased thickness following intraocular surgery even in patients without diabetic retinopathy. Sometimes corneal edema may persist following intraocular surgery in diabetic eyes. Therefore, assessing CCT in diabetic patients before any surgery is important.
Recently HbA1C level has been emphasized as a valuable marker of glycemic control. Haemoglobin is a protein found in red blood cells. In the bloodstream, glucose sticks to the red pigment in haemoglobin forming the HbA1C. Each red blood cell lives for 8-12 weeks. During this time, the more glucose present in blood, the more it will stick to the haemoglobin. HbA1C levels in blood provide guidance as to what the average blood glucose level has been for the past 2-3 months. Therefore, regular HbA1C testing tracks recent glycemic control. We investigated HbA1C values and their correlation to CCT. Patients with higher HbA1C levels (≥7%) had higher CCT than the patients with lower HbA1C levels (<7%). In contrast to our results, Larsson et al. and Keoleian et al. did not delineate any correlation between HbA1C and CCT. It has been shown that abrupt correction of hyperglycemia can result in transient hyperopia. One would expect that hyperglycaemia could affect corneal hydration as well and cause qualitative and quantitative corneal changes such as change in refractive index, curvature, and thickness. Higher HbA1C as a marker of poor glycemic control was associated with thicker corneas in our study. One would also expect that disease severity and duration would affect corneal thickness likewise. However, it was not possible to detect any effect of these factors on corneal thickness. This might be due to different homeostatic changes taking place during the chronic course of diabetics. Therefore, longitudinal follow-up studies need to be performed in order to ascertain the exact relationship of blood glucose levels on cornea.

REFERENCES


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**To Study Outcomes of Intrastromal Ring Segments in Management of Keratoconus**

**Dr. Lakshmi Krupa, Dr. Jyotyhsna Rajagopal, Dr. Sri Ganesh, Dr. Vidhyani**

Keratoconus (conical cornea) is a bilateral non inflammatory corneal ectasia with reported incidence being between 50-230 per 100,000 population.

Various treatment modalities are available in treatment of keratoconus. The newer treatment option available is kerarings. Keraring (intrastromal corneal ring segments) are implantable devices implanted in corneal stroma for correction of morphological and refractive disorders. It is manufactured from PMMA and is implanted in corneal stroma as per specific surgical technique. It acts upon corneal tissue by altering its central curvature and shape, thus reducing or eliminating morphological irregularities and existing myopia and astigmatism. It is composed of one or two semicircular segments of variable arc lengths, variable apical diameters, variable thickness, having a fixed triangular cross-section of 600 microbase. Each ring segment has a 0.2 mm diameter hole to facilitate manipulation and implantation.

Aim of this study is to evaluate visual outcome in patients of keratoconus implanted with Intrastromal kerarings at Nethradhama Superspeciality eye hospital, Bangalore. Also to evaluate whether kerarings delay or stop the progression of keratoconus.
MATERIALS AND METHODS

23 eyes of patients who were diagnosed to have Keratoconus were included in the study based on inclusion and exclusion criteria. Patients with Keratoconus with hydrops/scarring, glaucoma, retinal problems, with inadequate peripheral corneal thickness, other ectatic conditions like PMD, severe atopic disease, local active infection, recurrent corneal erosion syndrome/with corneal dystrophy were excluded from study.

All patients included in study underwent keraring implantation under topical anaesthesia with specific instrumentation from mediphacos (Brazil). Corneal tunnels were made with Intralase. The tunnel performed at 80% of corneal thickness with aid of femtosecond laser (intralase: femtosecond laser 60 KHz), which is a mode locked diode pump infrared, neodymium glass femtosecond laser (ultrafast 10-15) with a wavelength of 1053 nm. The laser beam of 3 micron diameter (spot size) is optically focused at a specific predetermined intrastromal depth by computer scanner which gives a focus (dissection) range between 90 and 400 microns from the corneal anterior surface. This beam forms cavitations and microbubbles of carbon monoxide and water vapour by photo disruption. The interconnecting of these bubbles forms a dissection plane.

A unique feature of femtosecond laser is ability to produce photo disruption of tissues at very low energy settings. This is due to short pulse width, or pulse duration (600-800 femtosecond) and very rapid pulse repetition or speed of laser (15,000 to 60,000 pulses per second). Thus, energy settings are low but high peak power retained. Hence, postoperative inflammation is reduced. Also increased speed reduces suction time thus providing enhanced safety and patient comfort. Tighter spot placement produces better dissection quality.

Keraring segment selection based on nomograms with spherical equivalent of myopia and distribution of cone on topography. Improvement in UCVA, BSCVA and topographic change (flattening) analyzed and discussed.

RESULTS

On statistical analysis of UCVA, all eyes in the study had a vision better than 6/36 with 2 eyes having 6/6. 82.6% of patients showed an improvement of 2-4 lines in UCVA while 17.4 % showed a 5-6 line improvement which showed statistical significance (p<0.001). Analysis of BSCVA, shows all eyes had a vision better than 6/12 with 4 eyes having vision of 6/6. 17.3% of eyes showed a 3-4 line improvement with a statistically significant (p<0.001) reduction in spherical equivalence from –10.75 to –1.75. 39.1% of eyes showed a 2-line improvement with a reduction in spherical equivalence from – 6.0 to –2.5, which
is statistically significant (p<0.001). 43.5 % of eyes showed 1 line improvement with a reduction in spherical equivalence from −4.56 to −2.5, which is statistically significant (p<0.001). Analysis of keratometric parameters showed a statistically significant reduction in Sim K Astig, Maximum K, Minimum K and irregularity index. Sim K Astig values showed a statistically significant reduction (p<0.001) of readings from (mean±SD) 6.30±2.91 to a 3.27±2.01 at 1 year. Maximum Keratometric (Max K/KV) values showed a statistically significant reduction (p<0.001) of readings from 54.96±6.11 to 49.28±3.89 at 1 year. Minimum keratometric (Min K/KH) values showed a statistically significant reduction (p<0.001) of readings from 48.65±4.89 to 46.02±3.52 at 1 year. Irregularity index values showed a statistically significant reduction (p<0.001) of readings from 6.73±2.94 to 5±2.31 at 1 year.

In conclusion intrastromal corneal ring segments (kerarings) provide a significant improvement in UCVA, BCVA and keratometric parameters. It reduces corneal irregularity with improvement in UCVA and BCVA.

REFERENCES

Peripheral Ulcerative Keratitis: An Unrecognized Threat

Dr. Dipali Satani R, Dr. Ruchi Shah, Dr. Shwetambari Singh, Dr. Amit Patel

Peripheral ulcerative keratitis (PUK) refers to a crescent-shaped destructive inflammation of the juxtalimbal corneal stroma. It is usually associated with an epithelial defect, presence of stromal inflammatory cells and stromal degradation. It is characterized by collagen destruction, cellular infiltration and limbal vascular changes indicative of vasculitis. Various pathophysiologic mechanisms have been proposed which include - the presence of autoantibodies to specific corneal proteins, aberrant expression of HLA class II antigens on corneal epithelial cells and keratocytes, immune complex deposition and up-regulation of the cytokine and collagenase production.

Severe pain and photophobia are the main symptoms of PUK. There is foreign body sensation and excessive watering. Slit lamp examination reveals a non-infiltrating ulcer at the periphery of the cornea with surrounding inflammatory infiltrate and conjunctival injection. Keratoconjunctivitis sicca is common. PUK, though classically associated with Rheumatoid arthritis (RA), has been described with Mooren’s ulcer, primary Sjogren’s syndrome, Polyarteritis nodosa, Wegener’s Granulomatosis, Relapsing Polychondritis, Churg Strauss syndrome, Systemic Sclerosis, Systemic Lupus Erythematosus, Sarcoidosis, Staphylococcal marginal keratitis, etc.

Many forms of medical and surgical treatments have been proposed in the past, but none of them regularly successful.

Aims of this study is:

• To find out the etiology of peripheral ulcerative keratitis (PUK).
• To apply the various possible modalities available for the treatment of peripheral ulcerative keratitis (PUK).

MATERIALS AND METHODS

It is a prospective interventional study done at Shree C.H. Nagri Municipal Eye Hospital from October 2009 to September 2010 wherein patients presenting with peripheral ulcerative keratitis in one or both eyes were included. During this period 16 cases were observed and detailed ophthalmic examination including visual acuity and slit lamp examination was done. Following laboratory investigations were done as required –

• Complete blood cell (CBC) count with Erythrocyte sedimentation rate (ESR)
• Urinalysis (UA), blood urea nitrogen (BUN), and creatinine
• Rheumatoid factor (RF)
• Angiotensin-converting enzyme (ACE)
• Antinuclear antibodies (ANA); Antibody to double-stranded DNA (anti-dsDNA); Antibodies to small nuclear ribonucleoproteins (anti-snRNP)
• Antineutrophil cytoplasmic antibodies (ANCA)
• Chest radiograph and sinus CT scan to rule out WG, sarcoidosis, and tuberculosis
• Radiographic studies of affected joints

Patients were then sent to a rheumatologist for systemic evaluation and management. Depending on the ophthalmic and systemic findings, patients were treated by various modalities as required.

Close follow up was done with regular monitoring of visual acuity and slit lamp findings.

RESULTS

Out of 16 patients included, 9 were due to RA and 7 were due to Mooren’s.

The mean age of patient’s with RA was 43.2 years while that of those with Mooren’s was 55.25 years.

Out of the 9 cases with RA associated corneal melt, 7 (77.77%) were females, correlating with female prevalence of RA. 7 (77.77%) of them had systemic features of RA in form of arthropathy and were on systemic treatment for the same. Out of the 9 cases, 6 (66.66%) cases had unilateral corneal involvement. Of the 6 cases with unilateral presentation, 5 of them presented with sterile corneal melt and iris prolapse of which 2 had small perforations which responded well to Cyano Acrylate Glue with Bandage Contact Lens (BCL) application. 2 of them were treated with Amniotic Membrane transplantation with Fibrin glue application. All 4 cases responded well with good re-epithelialisation of the corneal surface and maintenance of vision. One had a larger perforation and required patch grafting for the same. One patient had only mild marginal keratitis and healed well with topical drugs only. Of the 3 cases with bilateral involvement, 2 of them responded well with topical medications while one of them improved with conjunctival resection with Cyanoacrylate glue with BCL application.

Out of 7 cases with Mooren’s ulcer, 6 (85.71%) were male. 4 (57.14%) had unilateral corneal involvement. 2 of them were cases of atypical Mooren’s presenting in young males, one had bilateral involvement with LE lost due to Mooren’s ulcer 4 years ago and presented with RE Mooren’s ulcer with iris prolapse for which crescentric patch graft was done which proved eye saving as well as associated with some visual improvement. Another had unilateral presentation which worsened despite all measures and landed up...
in perforation and non salvageable eye. There was an old lady with bilateral Mooren’s ulcer with BE severe corneal melting for which patient was treated medically but patient was not compliant with treatment and worsened to BE corneal ulcer with abscess. Of the remaining 4 cases, 2 of them responded well to topical medications alone while 2 had limbal perforation for which conjunctival hooding was done.

Thus, overall of the 16 cases, 4(25%) patients improved with tissue adhesives, 5(31.5%) required surgical intervention, 5(31.5%) required only topical medications while 2(12.5%) worsened despite treatment.

**DISCUSSION**

Peripheral ulcerative keratitis is a potentially devastating disorder which can present in any age group. PUK produces great morbidity from pain and the resultant visual disability. The onset of PUK in the course of a connective tissue disorder may reflect the presence of a potentially lethal systemic immunological disorder. In the present study we prospectively analysed 16 patients of PUK presenting to the Cornea Clinic over a 1 year period. Age ranged from 25 to 70 years (mean age = 48.55 years).

PUK caused by RA is known to be more common in females than in males while Mooren’s ulcer is more common in males. The present study showed similar results. Out of 9 cases of RA, 7 were females, while out of 7 cases of Mooren’s, 6 were males. In our study, 62.5% cases were found to be unilateral while the remaining 37.5% bilateral. Eiferman et. al. have reported RA to be the most common collagen vascular disorder in the United States accounting for 34% of noninfectious PUK. Our study also found RA to be a commoner cause (56.25%). For the management of these cases, we have found that topical drugs as the sole source of therapy was sufficient in 31.5% of the cases. Of the remaining cases, 25% improved with tissue adhesives while 31.5% required surgical intervention. Tissue adhesives, such as cyanoacrylate glue were used in impending perforation and perforation size smaller than 1-2 mm. Adhesive application was combined with conjunctival resection when required to remove sources of collagenase, cytokines, and inflammatory cells from the ulcerated cornea, temporarily preventing further stromal loss. Application of a bandage contact lens prevented discomfort and dislodging of the adhesive. Amniotic membrane transplantation was used along with fibrin glue application. Amniotic membranes have properties that promote rapid healing and reduce ocular surface inflammation. Tectonic procedure such as corneoscleral patch graft was performed as needed to maintain the integrity of the globe when corneoscleral perforation had occurred. Foster et. al. have shown that local treatment alone is inadequate and immunosuppressive drugs in conjunction with early aggressive local management are required to halt the
relentlessly progressive inflammation. Hence, in spite of complete resolution in PUK, continued, possibly life long, follow-up of cases is necessary along with proper systemic management.

In conclusion PUK remains a major diagnostic and therapeutic challenge. Treatment of these patients has to be individualized depending on the presentation. Tissue adhesives can be used successfully to delay the need of major surgical interventions. Local treatment alone is inadequate and systemic immunosuppression must be included in management of PUK. The intensive cooperation of ophthalmologist and internist is required.

REFERENCES

Long-Term Results of Simultaneous Topo-Guided Partial PRK Followed by CXL for Keratoconus

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Corneal ectatic disorders, the most common of which is keratoconus, represent a group of conditions characterized by a bilateral state of tectonic corneal weakness that can lead to thinning of the cornea, production of myopia and irregular astigmatism, and visual acuity deterioration. Treatment options comprise two general approaches; firstly, vision restoration by means of spectacles or rigid gas permeable contact lenses and secondly, restoration of the tectonic integrity of the cornea such as intracorneal ring segments¹ and corneal collagen cross linking (CXL). In advanced cases of keratoconus lamellar or penetrating keratoplasty² are considered essential treatment possibilities in order to improve patients’ quality of life.
Corneal collagen cross linking is a minimally invasive technique utilizing riboflavin and ultraviolet – A irradiation for the enhancement of corneal rigidity. In particular, CXL augments the biomechanical strength of the cornea by inducing interfibrillar cross links of the stroma resulting in the stabilization of the disorder.

5-7 are extremely promising but patients’ poor vision quality remains largely unchanged, with minimal improvement.

Several combined procedures have been proposed in order to optimize the CXL result (such as conductive Keratoplasty followed by CXL) but it seems that the most effective is the combined topography-guided Photorefractive Keratectomy (PRK) followed by CXL. In this case series we present the long term results of simultaneous customized topography guided surface ablation followed by CXL in patients with keratoconus.

Design: Prospective, interventional study.

MATERIALS AND METHODS
Total of 245 eyes were recruited in the prospective study. Thirty one eyes (Twenty six patients) completed mean follow up upto approximately 2 years, which were analyzed for the purpose of long term results in this study. Mean age was 29.3 ± 8.5 years (range from 19 to 49 years).

Clinical evaluation
Preoperative evaluation consisted of general and ocular health history assessment, corneal topography (iTrace, Tracey Tech. Houston Texas), assessment of uncorrected distance visual acuity (UDVA), corrected distance visual acuity (CDVA), manifest refraction, scotopic pupillometry, central ultrasound pachymetry (Sonogage Corneo Gage Plus), and slit lamp examination of the anterior and posterior segments of the eyes. All patients underwent combined topoguided PRK with CXL with Pulzar solid state laser and standardized CXL protocol as per Dresden guidelines.

RESULTS
All values presented statistically significant differences between preoperative and last postoperative period. Mean preoperative spherical equivalent (SE) was -2.3 +/- 2.8 diopters (D), which significantly (p<0.001) reduced to -1.08 +/- 2.41 D at the last follow up. LogMAR UDVA and CDVA significantly improved by 0.46 and 0.084 LogMAR units, (p<0.001) at the last follow up. Mean steep and flat keratometry readings were reduced by 2.35 D (p<0.001) and 1.18 D (p<0.05). Confocal microscopy revealed deeper CXL effect than standard CXL.

DISCUSSION
CXL combined with topography – guided PRK has been developed in order to
achieve an important goal. To offer patients stability of their disorder and at the same time to assist them in achieving a functional vision.

In this study, there were no intra or post-operative complications noted. All the parameters analyzed, spherical equivalent refraction, UDVA, CDVA and mean keratometrics showed a statistically significant improvement (p<0.001) which remained stable throughout the follow-up period. The safety index of the combined procedure was 1.21 at the last follow-up examination. No eye has lost more than 2 lines of CDVA at the last follow-up period. None of our patients showed topographic or clinical signs of keratoconus progression during the follow-up. All patients showed marked improvement of corneal irregularity and visual acuity. Epithelium was removed in all cases by t-PTK. It is known that t-PTK uses an excimer laser ablation to remove the epithelium and smoothen the anterior irregular cornea. The aim of t-PTK was epithelial removal and anterior cornea smoothening in order to further decrease the irregular astigmatism.

In conclusion, long term results confirm the safety and stability of the combined PRK – CXL procedure. This combined treatment is capable of offering patients a functional vision and stabilization of their ecstatic disorder. Further follow-up and additional cases must be reviewed to draw final conclusions about the benefit of this surgical technique in keratoconic patients.

Unusual Case of Bilateral Corneal Melt

Dr. Sujata Dwivedi, Dr. Rachna Kumar, Dr. Kapil Vohra

Sterile corneal melt is usually associated with dry eyes, connective tissue disorder, vitamin A deficiency, neurotrophic ulcers, drug abuse or chemical injuries. However we present a case of bilateral sterile corneal melt in which we could not find any of the known causes of sterile corneal melt.

Case report: A 54- year-old lady presented to us with complaint of bilateral diminished vision. It started with bilateral redness 15 days back. There was no history of chemical injury, foreign body fall or trauma. She washed her eyes once a day with home made preparation of Boric acid dissolved in water for next two days. When there was no relief, she consulted an ophthalmologist, who diagnosed it as conjunctivitis and put her on Moxifloxacin eye drops and preservative free lubricating eye drops. Within a few days she developed sore throat, fever and enlarged sub mandibular lymph nodes. These symptoms lasted for 2-3 days only. There was no body rash or diarrhoea. Her redness in eyes persisted through out this period. Within one week of onset of ocular symptoms, she developed visual loss in the left eye (OS) followed by the right
eye (OD). Then, she consulted another ophthalmologist who put Bandage contact Lens (BCL) in OS and in OD the next day.

When she presented to us, her unaided visual acuity was counting finger 1 meter in OD and counting finger close to face in OS. There was diffuse conjunctival congestion in both eyes and bandage contact lenses were in place. There was no infiltrate in either eye. Anterior chamber was deep and there was no hypopyon in both eyes. BCL was removed to evaluate corneal pathology properly. Right eye cornea revealed a localized area (approximately 4 x 4mm) of marked corneal edema with no overlying defect. In the OS, central 3x 3mm of cornea revealed ectasia with thinning. The surrounding cornea had marked stromal edema.

With this clinical picture of corneal melt she was advised to undergo systemic evaluation to rule out any connective tissue disorder. She was advised to continue BCL in both eyes. She was put on oral Vitamin A and vitamin C and frequent instillation of preservative eye drops and prophylactic topical antibiotic drops.

A rheumatologist examined her and all her systemic investigations including ANA and CRP were normal. Ocular examination after 3 days revealed improvement in visual acuity in OD and decrease in epithelial defect size in OS. BCL was removed in OD after one week of initial presentation. By this time epithelial defect healed in OS also, leaving only central ectatic area with underlying corneal edema. BCL was removed one week after complete epithelialization in OS. Over next one-month corneal edema decreased in both eyes and scars developed in both eyes. Unaided vision improved to 6/18p in RE and 6/36 in LE.

**DISCUSSION**

Sterile corneal melt has been reported in specific groups of ocular, connective tissue and metabolic conditions. In our case, we could not find any evidence suggestive of severe dry eye, illness leading to vitamin A deficiency and subsequent keratomalacia or any connective tissue disorder. Though history of fever, sore throat and lymphadenopathy is suggestive of some viral illness, even then it does not fall into a known viral disease entity. Adenovirus is the most common cause of viral conjunctivitis and a particular subtype can cause pharyngoconjunctival fever. Ocular involvement is in this form of follicular conjunctivitis and occasional corneal involvement is limited to punctate keratitis and subepithelial infiltrates. Corneal melt has never been reported.

Other viruses like Herpes Simplex virus, Herpes Zoster Virus Epstein Barr also produce conjunctivitis, which is self-limiting, and corneal melt is not a primary feature. There was history of using home made boric acid preparation. It is a common practice in this part of world to wash eyes with this during
conjunctivitis and Boric acid is an ingredient of some topical medicines also. Whether it has contributed to illness is not clear. There was no history of use of topical NSAID’s. Thus etiology of corneal melt remained unknown in our case.

REFERENCES

Limbal Epithelial Transplantation in Vernal Keratoconjunctivitis with Limbal Stem Cell Deficiency

Dr. Kunjal Sejpal, Dr. Geeta Vemuganthi, Dr. Virender S. Sangwan

Vernal keratoconjunctivitis (VKC) is a chronic, recurrent allergic inflammation of the ocular surface, typically affecting young male individuals.1,2 Although the disease is seen across all continents, its prevalence is higher in the regions that have hot, humid climate or higher load of airborne allergens. An adult onset of the disease is also seen especially in tropical countries like India. Chronic VKC of the limbal form, can manifest with limbal stem cell deficiency. In an earlier report from our centre, the prevalence of LSCD in VKC was noted as 1.2%.3 This contributes to severe visual impairment and chronic symptoms, with a limited response to medical therapy.

Surgical intervention may be necessary in severe cases. We have reported the outcomes of autologous ex vivo cultivated limbal epithelial transplantation (CLET) in unilateral LSCD secondary to chemical burns.4

Purpose of this study is to evaluate the role of autologous ex vivo cultivated limbal epithelial transplantation in the management of limbal stem cell deficiency in vernal keratoconjunctivitis.

MATERIALS AND METHODS

This technique was approved by the Institute Review Board and was conducted in strict adherence to the Indian National Guidelines on Stem Cell
Research and Therapy. Written informed consent from parents or guardians was obtained.

Records of all cases of CLET between April 2001-2010 were reviewed and cases of VKC were identified.

Patient selection
All patients with VKC, in quiescent stage, who presented with conjunctivalization, epithelial breakdown and chronic inflammation were classified as VKC with LSCD. Patients with unilateral LSCD or bilateral partial LSCD were selected for autologous CLET.

Limbal epithelial cell culture
The limbal biopsy was taken from a healthy area of the limbus from the ipsilateral or contralateral eye. It was cultivated by a simple feeder cell-free explant culture method using autologous serum that generates the corneal epithelium within 10-14 days. This epithelium further stratifies in vivo. Cultures covering more than 50% area of 2.5cm x 5cm human amniotic membrane were considered adequate for clinical use.

Surgical Technique and Post-operative management
Dissection of the ocular surface pannus was started 2-3mm behind the limbus with the help of blunt tip spring scissors or conjunctival scissors and a # 15 blade on a Bard Parker handle. A combination of sharp and blunt dissection from the periphery towards the central area was carried out to clear the cornea. Cultivated limbal epithelium on human amniotic membrane was brought on to the ocular surface, cell side up, and the membrane containing the cultured cells was gently spread over the cornea as well as limbus without damaging or dislodging the cells. The membrane was secured to the ocular surface with 10-0 monofilament nylon material or fibrin glue (Tisse[™ Kit; Baxter AG, Vienna, Austria). Postoperatively all patients were treated with 1% prednisolone acetate eye drops eight times a day tapered to once a day in 4 to 6 weeks and 0.3% ciprofloxacin hydrochloride eye drops four times a day for 1 week or until the surface epithelium healed.

RESULTS
CLET was performed in 4 eyes of 3 patients.

The average duration of symptoms prior to CLET was 69 months. The mean age at the time of surgery was 23 (17-32) years. LSCD was total in 3 eyes and near total in 1 eye. At a mean follow-up of 7.3 years, CLET was successful in 2 eyes, partially successful (recurrence of conjunctivalization) in 1 eye and failed in 1 eye. Symptoms improved in all patients. Visual acuity improved in 3 eyes and remained stable in 1 eye.
Case 1
A 17 year old female, presented with redness, watering, itching in both eyes since 10 years of age and decrease in vision in the right eye since 1 year. She underwent pannus resection + conjunctival autograft in the right eye.

Post surgery, patients complained of photophobia, irritation. The BCVA in OD was 20/60 and in OS was 20/20. Slit lamp examination showed 360\(^\circ\) conjunctivalization in OD and partial conjunctivalization in OS. The patient underwent a limbal biopsy in OS and autologous CLET in OD. 4 years later, keratoconus was observed in OD and visual acuity improved to 20/20p with Boston scleral contact lens until 8 years of follow-up.

Case 2
A 32 year old female, presented with redness, watering, itching in both eyes since 30 years and decreased vision in the left eye since 6 years. The BCVA in OD was 20/20 and in OS was CF @ 2 metres. Slit lamp examination in OD showed 120\(^\circ\) conjunctivalization and in OS showed 360\(^\circ\) conjunctivalization and corneal scarring. Patient underwent limbal biopsy in OD and CLET in OS. 2 months post surgery vision in OS improved to 20/100. Patient was then lost to follow-up. 6 years later, patient developed partial recurrence of conjunctivalization superiorly, but maintained a BCVA of 20/30.

Case 3
A 21 year old male presented with redness, itching and gradual decrease in vision in both eyes since 5 years. His BCVA OU was 20/80. Slit lamp examination showed 360\(^\circ\) conjunctivalization in OD, 330 conjunctivalization in OS with corneal scarring. The patient underwent a limbal biopsy from a healthy limbal area in OS which was cultivated on 2 amniotic membranes. CLET was performed in OU, 2 days apart. OD CLET was successful, however OS failed. 6 months post CLET the BCVA in OD was 20/60, while in OS BCVA was 20/200. The patient later developed keratoconus. 8 years post CLET, the BCVA in OD with RGP contact lens was 20/25, and in OS with Boston scleral contact lens was 20/64.

DISCUSSION
Limbal inflammation in VKC, along with effect of toxic products of eosinophils on limbal stem cells, in chronic VKC may cause LSCD.\(^5,6\) We have earlier reported an incidence of 1.2% of LSCD in VKC, mostly in young adults.\(^3\) Bilateral LSCD in VKC may required allograft limbal transplantation, with immunosuppression.\(^5,6\)

However, in unilateral LSCD, or bilateral partial LSCD, autologous limbal tissue can be used for culture on amniotic membrane, thus avoiding immunosuppression.\(^4\)
In conclusion advanced VKC may present with LSCD and management is challenging.

Although our series is small, symptomatic improvement was noted in all patients and visual acuity improved in most patients. Autologous CLET is a viable and excellent option for cases with unilateral/bilateral partial LSCD.

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