Abstract

Compare the effectiveness of Phototherapeutic keratectomy (PTK) in treatment of corneal dystrophies and superficial corneal scars with recurrent corneal erosions: visual outcomes, recurrence rate and safety profile.

Methods

PTK was performed in 73 eyes of 64 patients. Data regarding the demography, indications for PTK, ablation depth, optical zone, keratometry, BCL removal, symptomatic relief, pre-and postoperative best spectacle-corrected visual acuity (BSCVA), spherical equivalent changes, recurrence and complications were analyzed. The indications for PTK in our study were classified into two categories – group A: eyes with corneal dystrophies and corneal scars (n=41) and group B (n=32) with recurrent corneal erosions.

Results

The average age of the patients was 32.25 years (±16.4). The mean follow up period was 3.875 months (±10.01 months). The ablation depth in Group A ranged from 100 μ to 15 μ and in group B 5 μ to 10 μ Post operatively, there were no significant complications. All eyes were epithelized within 7 days ( average 4 days ) While the overall BSCVA in the patients improved from 1.78 (LogMAR) to 0.18 in group A as compared to group B in which BSCVA improved from 1.19 (logMAR) to 0 The most common indication in group A was superficial stromal corneal dystrophy (n=32) and the most common indication in group B was post traumatic/corneal erosions (n=30 ). Ninety-six percent (n=62) of all patients had alleviation of symptoms. Recurrence of symptoms was seen in 1 eye with recurrent corneal erosions which required retreatment.

Conclusion

PTK is a safe and effective procedure. This study outcome suggests that PTK improves BSCVA. PTK appears to improve ocular surface health. Furthermore, PTK can be recommended to most patients with corneal dystrophies as a treatment modality prior to other more invasive procedure (viz. penetrating keratoplasty).

Keywords

phototherapeutic keratectomy, PTK, corneal scars, keratoplasty, corneal dystrophy, recurrent corneal erosions

Introduction

Corneal diseases such as scars, degenerations, dystrophies, bullous keratopathy, and band-shaped keratopathy (BSK) are important causes of corneal blindness; anterior stromal disease being superficial can be treated using various minimally invasive surgical procedures like lamellar keratoplasty (LKP) or superficial keratectomy or by excimer lasers, that is, phototherapeutic keratectomy (PTK). Phototherapeutic keratectomy (PTK) is an important excimer laser based surgical tool for the treatment of numerous anterior corneal disorders. PTK can be considered to be a bridge between medical and surgical management of corneal diseases. Apart from macular,1 granular2, lattice3 and map dot fingerprint4 dystrophies; other indications for which PTK has been reported to be an effective treatment include recurrent corneal erosion syndrome5–7 stromal scar tissue such as post surgical scars and Salzmann nodular degeneration.

Aim

We evaluate in this study the effectiveness of PTK in treatment of variable pathologies with anterior corneal lesions.

Materials and Methods

All cases of corneal disease which had undergone PTK from January 2010 to December 2012 at the Excimer Lasik Centre were retrospectively reviewed. The details of the cases were retrieved from the medical records. A thorough preoperative clinical evaluation was performed for all patients. This included detailed history, refraction, Slit lamp examination, Corneal Topography, ultrasonic Pachymetry, schirmer’s test, intraocular pressure measurement and posterior segment evaluation.
Photo Therapeutic Keratectomy (PTK) was performed in 73 eyes of 64 patients. The PTK Corneal ablations were performed under topical anesthesia. A 6 to 6.5 mm treatment zone was used. Allegreto Wavelight Excimer Laser was used in all cases, and included a 193-nm UVC beam.

Central corneal epithelium was removed using 20% Alcohol applied for 20 seconds. The corneal deposits were thoroughly scraped using a scraper. The surface was smoothened of the underlying irregularities by doing PTK.

A thin layer of sodium hyaluronate, 0.1%, was then applied with a lightly moistened surgical sponge and PTK resumed. One surgeon (AJ) performed all surgeries. At the end of the procedure, Moxifloxacin 0.5% or Ofloxacin 0.3% eye drops were instilled. A bandage contact lens was placed in the eye and immediate slit lamp examination was conducted. Patients were then put on Fluorometholone, 0.1% for one month in a tapering dose and antibiotic eye drops for one week.

Patients were followed up at approximately 1 week, 1 month, 3 months, 6 months, and at 1-year intervals thereafter. During each visit, ophthalmologic examinations were performed.

Data regarding the demography, indications for PTK, ablation depth, optical zone, keratometry, BCL removal, symptomatic relief, pre-and postoperative best spectacle-corrected visual acuity (BSCVA), spherical equivalent changes, recurrence and complications were analyzed. The indications for PTK in our study were classified into two categories – group A: eyes with corneal dystrophies and corneal scars (n=41) and group B (n=32) with recurrent corneal erosions.

Results
Patient characteristics
73 eyes of 64 patients were operated upon. The average age of the patient was 32.25 years (±16.4). 35 patients were female and 29 were males. 35 of the eyes were right eyes and 38 were left eyes.

Indications for PTK
The indications for PTK in our study were classified into two categories – group A: eyes with corneal dystrophies and corneal scars (n=41) and group B (n=32) with recurrent corneal erosions.

The most common indication in group A was superficial stromal corneal dystrophy (n=32) and the most common indication in group B was post traumatic/corneal erosions (n=30).

<table>
<thead>
<tr>
<th>Indication</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Granular Dystrophy</td>
<td>11</td>
<td>15.06%</td>
</tr>
<tr>
<td>Macular Dystrophy</td>
<td>15</td>
<td>20.6%</td>
</tr>
<tr>
<td>Band Shaped Keratopathy</td>
<td>6</td>
<td>8.2%</td>
</tr>
<tr>
<td>Lattice Dystrophy</td>
<td>1</td>
<td>1.3%</td>
</tr>
<tr>
<td>Post traumatic scars</td>
<td>10</td>
<td>13.6%</td>
</tr>
<tr>
<td>RCE ( Idiopathic)</td>
<td>21</td>
<td>28.76%</td>
</tr>
<tr>
<td>RCE ( post traumatic)</td>
<td>7</td>
<td>9.58%</td>
</tr>
<tr>
<td>RCE ( Dystrophic)</td>
<td>2</td>
<td>2.73%</td>
</tr>
</tbody>
</table>

Abbreviation: RCE Recurrent Corneal Erosion

Ablation depth
The ablation depth in Group A ranged from 100 μ to 15 μ and in group B 5μ to 10 μ

Post operatively, there were no significant complications. All eyes were epithelized within 7 days (average 4 days)

While the overall BSCVA in the patients improved from 1.78 (LogMAR) to 0.18 in group A as compared to group B in which BSCVA improved from 1.1 9 logMAR) to 0

Ninety -six percent (n=62) of all patients had alleviation of symptoms. Recurrence of symptoms was seen in 1 eye with recurrent corneal erosions which required retreatment.

Discussion
PTK has been used as an effective therapeutic tool in the management of corneal pathologies for over two decades now. It has several advantages such as precise control of the depth of ablation, fast postoperative recovery, ease of use, creation of a smooth base for corneal re-epithelialization, and the ability to repeat treatment if required. PTK is best suited for disorder in the anterior 10%-20% of the corneal stroma.

In our study, patients were classified depending on the indication, and formed 2 groups; group A had patients with corneal dystrophies and group B included recurrent corneal erosions; because PTK in corneal dystrophies benefit from both visual clarity as well as treat the associated recurrent corneal erosions, while other superficial corneal pathologies in group B benefit mainly from the visual disturbance as well as symptomatic relief.
There is one large series Indian study. Sharma et al\(^9\) stated that in their study, bullous keratopathy accounted for 52.7% of the patients and a mere 0.15% of the patients had corneal dystrophies. In the study by Sharma et al, patients were divided into two groups: those with bullous keratopathy and those with other corneal pathologies.

The mean improvement of BSCVA seen was 20/222 (0.09) to 20/86 (0.23) in the corneal pathology group and 20/384 (0.05) to 20/202 (0.09) in the bullous keratopathy group. In our study, the overall BSCVA in the patients improved from 1.78 (LogMAR) to 0.18 in group A as compared to group B in which BSCVA improved from 1.19 logMAR) to 0.

In Group A, comprising of patients with corneal dystrophies, the improvement of BSCVA was in accordance with other similar studies by Hafner et al\(^1\) and Wagoner and Badr.\(^10\) Hafner and co-authors reported temporary improvement in BSCVA in patients with macular dystrophy for limited time period in which 90% of cases had dystrophy recurrence and 60% did penetrating keratoplasty in a later date. This was probably due to diffuse corneal haze and the opacities persisting in the deeper layers of the cornea after PTK.\(^1\) This explains the importance of having PTK in superficial corneal dystrophy to have the best visual results.\(^10\)

In the PTK literature for recurrent corneal erosions, the reported rate of success, regarding alleviation of symptoms and prevention of recurrence ranges between 74% and 100%.\(^11\) In our study Ninety-six percent of all patients had alleviation of symptoms. Recurrence of symptoms was seen in 1 eye with recurrent corneal erosions which required retreatment.

Our case series, had post traumatic recurrent corneal erosions (RCE) 21 eyes with idiopathic recurrent corneal erosion patients and two eyes with Map dot fingerprint dystrophy, who were treated with PTK. The mean follow up period for the RCE patients was 19.14 months (±8.78, range: 12–36 months) and of these patients one eye needed a repeat procedure at 3 months after the first procedure respectively.

Furthermore, Barlya et al studied the efficiency of PTK for RCE. The mean follow up period was 17.4 months. They reported the recurrence rate of RCE to be 36% of which is higher than our results All recurrences in the current study were in the first year after the procedure similar to the other studies in which most recurrences were noted in the first year. In a recent review of recurrent corneal erosion syndrome, PTK was found to be the most effective treatment modality.\(^11\) This is partly explained by the observed histological findings that PTK increases the density of hemidesmosomes in the cornea.\(^12\)

In our study, corneal haze was rare and the significant induced hyperopia was limited for cases with deeper PTK ablation. In our series, there was no significant change in the spherical equivalent post-PTK in the recurrent erosion patients secondary for the superficial stromal ablation (10 microns).

PTK is a safe and minimally invasive procedure for the treatment of superficial opacities and helps to gain a moderate increase of visual acuity. Patients with stromal corneal dystrophies also benefit from improved vision as demonstrated in our study.

Treatment in these cases when performed for reduced visual acuity is largely successful by clearing central corneal opacification and deposits. Mild transient superficial stromal haze developed in some (55%) eyes in this series, but visual improvement and rehabilitation was rapid in the majority of cases.

A repeat PTK procedure can be performed for recurrence of dystrophies which is usually central and superficial may help maintain good visual acuity for a longer period of time. This reduces the strain on the supply of corneal buttons, especially in developing countries.

Also a prior PTK procedure does not compromise the outcome of subsequent penetrating keratoplasty. Refractive changes following PTK are variable. Induced hyperopia does occur when deeper ablation is performed. A “hyperopic shift” was seen only in the 33% patients in the current study. A possible explanation for this could be a large ablation zone, the use of masking fluid, and the centration of the laser aperture over the mid periphery and not the apex of the cornea. A myopic shift was seen in 17% of subjects in this study possibly as a result from central steepening of the cornea with more peripheral ablations or due to central island formation. This can be confirmed by topographic studies. Unfortunately due to the retrospective study we could not assess this aspect on topography. Some of the other factors that may affect the refractive results include epithelial remodeling, associated nuclear sclerosis, or the inaccuracy of preoperative refraction due to corneal scarring.

**Conclusion**

To conclude, our study shows that PTK is a safe, simple
and effective procedure that helps achieve symptom alleviation, increase visual acuity, and delays the need for penetrating keratoplasty, and PTK has minimal side effects and complications.

References