

# Phototherapeutic keratectomy for anterior stromal fibrosis following DMEK

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## ABSTRACT

**Purpose:** Anterior stromal fibrosis is often seen in advanced cases of Fuchs endothelial dystrophy or secondary endothelial insufficiency. As Descemet membrane endothelial keratoplasty (DMEK) can completely eliminate the corneal edema and the guttae in these patients, anterior stromal fibrosis often remains leading to a reduction in visual function.

**Observations:** In such situations phototherapeutic keratectomy can be an effective tool to remove the opacifications in the anterior corneal stroma and improve the visual function as presented in two clinical cases.

**Conclusion:** DMEK can be the method of choice even in advanced cases of endothelial insufficiency with clinical significant fibrosis of the anterior corneal stroma.

## 1. Introduction

During the last decade posterior lamellar keratoplasty has become the first line surgery for patients with endothelial dysfunction like Fuchs endothelial dystrophy or secondary bullous keratopathy. Regarding the surgical technique Descemet membrane endothelial keratoplasty (DMEK) delivers faster visual rehabilitation than Descemet stripping automated endothelial keratoplasty (DSAEK).<sup>1</sup> Yet, both treatments can completely restore the function of the endothelial cell layer. When Ernst Fuchs primarily described the disease in 1910<sup>2</sup>, he suspected the corneal endothelium to be responsible for the clinical changes he could observe, but he called the disease „dystrophia epithelialis corneae“ because without a slitlamp he could recognise primarily the epithelial changes of the cornea. So of course, in advanced cases of bullous keratopathy the corneal stroma reacts to the chronic edema by fibrotic changes<sup>3</sup> and subsequently subepithelial scars can be observed due to recurrent corneal epithelial defects. However, in less advanced stages of Fuchs endothelial dystrophy characteristic fibrotic changes in the anterior subepithelial stroma and some kind of a secondary epithelial basement dystrophy can be found as well. Therefore, even after restoration of the endothelial cell function by DMEK or DSAEK and elimination of the stromal edema these fibrotic changes may remain leading to a reduced visual function of the patients. If the opacities and irregularities are caused by the epithelial layer or a subepithelial pannus, this can be treated by epithelial and/or pannus removal before or even during posterior lamellar keratoplasty. In such cases the anterior segment OCT can be helpful to distinguish between fibrosis in the anterior stroma and

subepithelial pannus/epithelial irregularities. If anterior stromal fibrosis seems to reduce visual acuity or lead to visual discomfort following posterior lamellar keratoplasty, phototherapeutic keratectomy (PTK) might be a good therapeutic option to reduce visual discomfort of the patients like light sensitivity and improve visual acuity. Here, we present two cases of patients having undergone PTK due to significant anterior stromal fibrosis following DMEK.

## 2. Case presentations

### 2.1. Findings

#### 2.1.1. Case 1

A 69-year-old female patient with Fuchs endothelial dystrophy and cataract underwent DMEK combined with cataract surgery (triple DMEK) in her right eye in November 2014. At the time of this surgical intervention visual acuity was 0.3 (decimal unit), the cornea showed confluent guttae with bullous keratopathy and subepithelial fibrosis. Triple DMEK as well as the postsurgical course were uneventful with primary graft attachment and rapid clearing of the cornea. However, the remaining fibrosis of the subepithelial stroma lead to a reduction of visual acuity to 0.2 (decimal unit) and significant visual discomfort for the patient. Fig. 1 demonstrates the stromal fibrosis in a slitlamp photograph (Fig. 1A) and in the anterior segment optical coherence tomography (OCT, Fig. 1C). Therefore, five months following triple DMEK we performed PTK using the Amaris 500Hz excimer laser (Schwind, Kleinostheim, Germany) with an aberration-free ablation of

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30  $\mu\text{m}$  over an 8mm zone. Four weeks following PTK the stromal fibrosis had been significantly reduced (see Fig. 1B and D). Visual acuity was 0.3 (+1.50/-3.00/100°, decimal unit), but the visual complaints of the patient had significantly improved. One year after surgery the patient was very satisfied with her visual function and visual acuity was 0.32 (+3.25/-4.00/96°, decimal unit). The reasons for the reduction in visual acuity were that there were still refractive irregularities of the corneal surface (measured by Scheimpflug tomography) and a mild macular degeneration with some subretinal drusen.

2.1.2. Case 2

In May 2013 we performed a triple DMEK in a 63-year-old male patient with Fuchs endothelial dystrophy and cataract. At the time of surgery best corrected visual acuity was 0.32 (decimal unit) and the cornea showed significant fibrosis in the anterior stroma due to recurrent epithelial defects of the cornea for many years. Six weeks following triple DMEK best corrected visual acuity was 0.5 (decimal unit) and the cornea showed anterior stromal fibrosis and “maps” of the corneal epithelium causing visual discomfort for the patient (see Fig. 2A and B). Therefore, 6 months following triple DMEK the patient underwent PTK (25  $\mu\text{m}$  aspheric ablation, 9.0mm zone) using the Amaris 500Hz excimer laser (Schwind, Kleinostheim, Germany). Ten months after PTK best corrected visual acuity had improved to 0.8 (decimal unit) and the fibrotic changes on the anterior stroma had also been reduced. The patient furthermore received regularly intravitreal injection with bevacizumab for the treatment of diabetic macular edema.

3. Discussion

Many different corneal pathologies like corneal dystrophies, anterior corneal scarring or recurrent corneal erosions can be treated by excimer laser based phototherapeutic keratectomy mainly by improving corneal clarity and smoothening the corneal surface.<sup>4</sup> In the literature only a few cases of PTK following DSAEK but not following DMEK have been described. In 2010 Hongyok et al.<sup>5</sup> were the first ones who treated two patients with PTK including mitomycin C for anterior stromal fibrosis after DSEK. In case 1 they observed an increase of best corrected visual acuity from 20/400 to 20/40 and in case 2 from 20/100 to 20/40. Awdeh et al.<sup>6</sup> describe two cases where they performed PTK without mitomycin in case 1 and a photorefractive keratectomy without

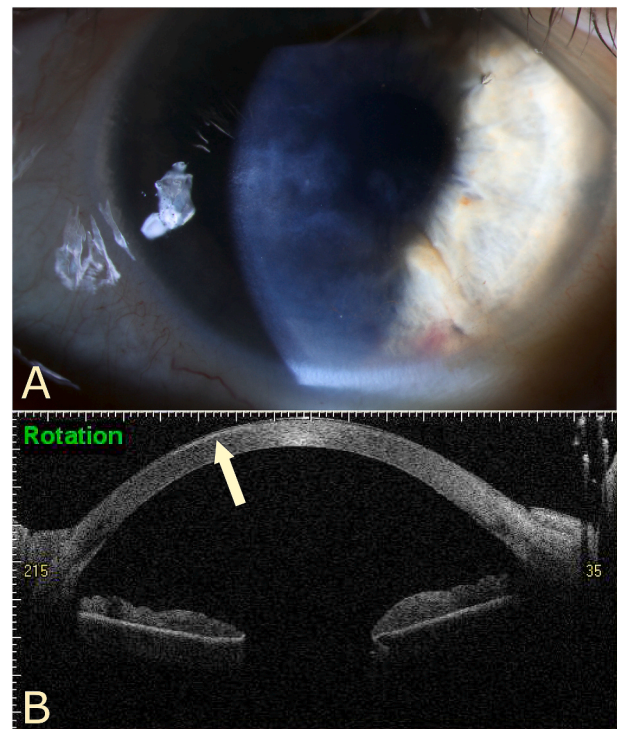


Fig. 2. Significant opacification in the central cornea due fibrotic changes in the subepithelial stroma 6 months after DMEK (A) that can also be seen in the anterior segment OCT as a subepithelial hyperreflectivity (B, arrow).

mitomycin in case 2 following DSAEK due to significant fibrosis in the anterior stroma. In both cases best corrected visual acuity could be significantly increased from 0.25 to 0.5 (case 1) and from 0.5 to 0.8 (case 2). In the second case a myopic refractive error of  $-3.25/+1.0/$  was additionally corrected so that only a refraction of  $-0.75$  remained. Finally, Lee and Hardten<sup>7</sup> report on a retrospective case series of 10 patients undergoing PTK following DSAEK. They observed only a mild improvement of mean best corrected visual acuity from 0.43 to 0.36 (logMAR,  $P = 0.24$ ), but 80% of patients reported on improvement of

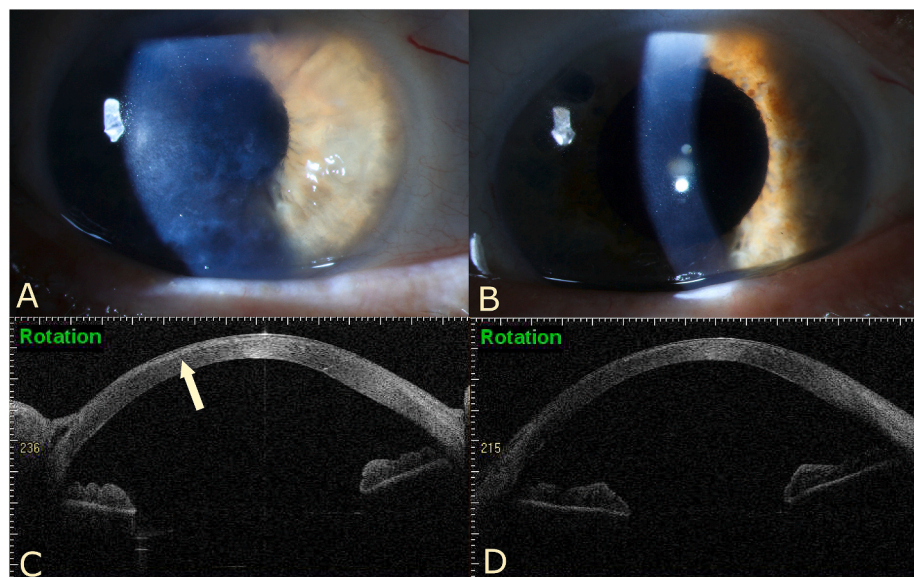


Fig. 1. Clinical picture of the cornea showing the fibrosis in the anterior corneal stroma looking like a superficial scar three weeks after DMEK (A) which has almost completely disappeared 6 months after PTK (B). Dense hyperreflectivity in the anterior subepithelial stroma in the OCT demonstrating the fibrotic changes (C, arrow) being significantly reduced by PTK (D).

their overall visual function. In five patients an additional refractive correction was performed and in nine of these cases the surgeons used mitomycin C for 15–90 seconds without any postsurgical drops in endothelial cell densities. If subepithelial fibrosis is seen before posterior lamellar keratoplasty and PTK can be anticipated as the fibrosis might influence visual acuity significantly, in case of combined phacoemulsification the hyperopic shift that can be induced by PTK should be considered for the selection of the respective IOL. In such cases a more myopic refractive error instead of emmetropia might be chosen.

In our two patients we did not use mitomycin C because the amount of ablated tissue was only 25–30 µm and we did not want to risk any loss of endothelial cells, although the risk of endothelial cell damage by mitomycin C during excimer laser surgery is still controversial.<sup>8</sup> We also did not perform any additional refractive correction as in case 1 the topography showed very irregular astigmatism and in case 2 there was an only mild refractive error following triple DMEK.

#### 4. Conclusions

Taking the experiences of the cases with PTK following DMEK presented here and the results from the literature following DSAEK we think that in patients with Fuchs endothelial dystrophy or secondary endothelial failure even with significant anterior stromal fibrosis DMEK should be preferred to penetrating keratoplasty or DSAEK because even in the presence of visually relevant fibrosis of the anterior corneal stroma the visual function of the patients might still be improved by PTK with a low risk profile.

#### Patient consent

Consent to publish the case report was not obtained. This report does not contain any personal information that could lead to the

identification of the patient.

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