Romanian Journal of Ophthalmology, Volume 59, Issue 3, July-September 2015. pp:159-163

GENERAL ARTICLE

FUCHS ENDOTHELIAL CORNEAL DYSTROPHY: IS FEMTOSECOND LASER – ASSISTED CATARACT SURGERY THE RIGHT APPROACH?

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Accepted: July 18, 2015

Abstract

Introduction: Femtosecond Laser – assisted cataract surgery represents a modern technology that hopes to lower the risk of complications for patients suffering from Fuchs endothelial dystrophy by using a reduced level of energy that causes less damage to the endothelium, the main concern for patients with Fuchs endothelial dystrophy. The femtosecond laser performs 3 important steps in cataract surgery: corneal incisions, capsulorhexis and nucleus fragmentation without intraocular instrument manipulation. **Purpose:** The purpose of this study is to determine the efficiency of Femtosecond Laser – assisted cataract surgery in Fuchs endothelial dystrophy.

Material and methods: 5 patients with 6 eyes underwent cataract surgery assisted by Femtosecond Laser LensX at Laser Optisan Clinic. Corneal changes before and after surgery and cumulative dissipated energy (CDE) were analyzed.

Results: Before surgery, our patients presented BCVA between 0.16 – 0.4, Pachymetry between 450-590 µm, endothelial cells between 789-2008 mm^2. The medium cumulative dissipated energy (CDE) used was 4.58 seconds. After surgery, BCVA improved in all patients and none of them developed corneal decompensation so far.

Conclusions: Femtosecond Laser – assisted cataract surgery represents a safe alternative in patients with Fuchs endothelial dystrophy and has a low risk of corneal decompensation.

Key words: Femtosecond Laser – assisted cataract surgery, Fuchs endothelial dystrophy, Endothelial cell

Introduction

Fuchs Endothelial Corneal Dystrophy (FECD) represents a non-inflammatory dystrophy of the corneal endothelial layer which involves the presence of guttata – small excrescences on Descemet's membrane due to abnormal elaborations of basement membrane and fibrillar collagen by the damaged endothelial cells.

When a patient suffering from mild or moderate FECD undergoes cataract surgery, the main concern of the surgeon is to cause less damage to the already altered corneal endothelium because at densities less than 1,000 endothelial cells/mm^2, the risks of significant corneal decompensation with cataract surgery increases in patients with FECD hasting this way the need for DSEK surgery or corneal transplant.

In patients with FECD that are scheduled for cataract surgery it is very important to complete a precise diagnostic workup analyzing existing corneal changes and these patients require additional consideration in choosing the best and safest surgical technique to obtain the best visual outcome.

Anterior segment imaging, by means of specular microscopy, confocal microscopy or optical coherence tomography (OCT) offers the possibility to study corneal changes after cataract surgery by showing a magnified view of the corneal endothelium including measurements of cell density and morphology of the cells and pachymetry. While FECD is characterized by increased polymegethism, decreased hexagonality as well as thickening of the cornea which reveals cell loss and subsequent changings of surrounding cells to fill in the compromised endothelium and also coalescing guttatae, cataract surgery can cause true trauma to the already fragile cornea [**1**].

Also corneal tomography can show a pattern compatible with subclinical edema that implies a straightened or horizontal pachymetric progression profile [**2**].

Femtosecond Laser - Assisted Cataract Surgery represents a modern and safe approach that hopes to lower the risk of complications in patients suffering from FECD.

The femtosecond laser performs corneal incisions, capsulorhexis and nucleus fragmentation without intraocular instrument manipulation this way reducing the amount of ultrasound energy causing less damage to the endothelium. Fragmentation of the leans with femtosecond laser has shown to reduce the average time and energy required by approximately 50% (Batlle J.F., unpublished data, [2011]), (Edwards K., unpublished data [2011]), [**3**].

In addition, usage of dispersive viscoelastic and performing "cataract in the bag phacoemulsification" is indicated.

Objective

The purpose of this study is to determine the efficiency of Femtosecond Laser – Assisted Cataract Surgery in patients suffering from mild and moderate FECD with cataract by studying the corneal changes.

Material and methods

Within 2013–2015, 5 patients (6 eyes) with mild-moderate FECD underwent Femtosecond Laser - assisted cataract surgery at Laser Optisan Clinic (Cluj-Napoca).

3 patients (3 eyes) had clinically transparent cornea and 2 patients (3 eyes) had subclinical stromal edema.

Surgery was performed by the same surgeon with LensX Femtosecond laser and Centurion phacoemulsification system (torsional mode). „Cataract in the bag phacoemulsification" was performed. Excessive dispersive viscoelastic devices were used.

Parameters followed were:

- BCVA before and after surgery;
- Corneal changes before and after surgery were made 1 day before and 1 month after surgery:
  - ✓ Measurements of the central corneal thickness and subclinical corneal edema (Allegro Oculyzer Wavelight);
  - ✓ Endothelial cell density (Konan Noncon Robo Specular Microscope);
- Cumulative dissipated energy (CDE).

After surgery intensive steroids and antibiotic eye drops (Tobramicinum + Dexametazonum) were applied to minimize the inflammatory damage to the corneal endothelium.

All patients gave their consent for the use of their data in this study.

Results

The average age of the 5 patients enrolled in this study was 69.4 (54-77). 4 patients were female and 1 was male, which attest the higher frequency of women suffering from FECD.

The preoperative mean BCVA was 0.25 (range 0.1 - 0.4) while 1 month after surgery mean BCVA increased to 0.73 (range 0.4 - 1) (**Table 1**).

One of the patients was known to have glaucoma (P1) while another mild non-proliferative diabetic retinopathy (P2).

Preoperative data collected revealed: average central corneal thickness was 533 µm (range 450-590 µm), none of the patients having a pachymetry over 600 µm, average endothelial cell density was 1120 cells/mm^2 (range 749-2008 cells/mm^2) (**Fig. 1**). None of the patients presented clinical corneal edema, but 2 patients (P1, P3) had subclinical corneal edema (**Table 2**).

Table 1: Patients' BCVA evolution

	Gender	Age	Eye	BCVA	
				Before	***After 1 month***
P1	F	77	OD	0.25	0.4
			OS	0.1	0.4
P2	F	72	OD	0.25	1
P3	M	74	OD	0.25	0.7
P4	F	54	OS	0.4	1
P5	F	70	OS	0.2	0.9
				Average = 0.25	*Average = 0.73*

Postoperative, a month after surgery we noticed: decrease in endothelial cell density to an average of 1111.8 cells/mm^2 (range 735-2004 cells/mm^2) with an average rate of decrease of 0.73% and increse of central corneal thickness to 537.83 µm (range 457-592 µm) with an avarage rate of increase of 0.89% (**Fig. 2**) (**Table 2**).

Regarding corneal edeman just 2 of the patients (P1, P3) had moderate edema and corneal folds which has been resolved in a few days, both patients having before surgery an endothelial cell density under 1,000 cells/mm^2 (**Table 2**).

During cataract surgery, the average CDE used varied between 1,95 seconds to 6.98 seconds, with an average of 4.58 seconds (**Table 2**).

Table 2: Corneal changes before/after surgery and CDE

		P1		P2	P3	P4	P5	*Average*	
		OD	**OS**	**OD**	**OD**	**OS**	**OS**		
Endothelial Cells	***Before***	749	848	2008	805	1355	957	*1120*	*↓ with*
Density (cells/mm^2)	***After 1 month***	735	843	2004	792	1349	948	*1111.8*	*0.73%*
Pachymetry	***Before***	450	512	590	578	572	499	*533*	*↑ with*
(µm)	***After 1 month***	457	517	592	584	573	504	*537.83*	*0.89%*
Corneal Edema	***Before***	S.E.	S.E.	-	S.E.	-	-		
	After 1 month	S.E.	S.E.	-	S.E.	-	-		
CDE (seconds)		4.06	4.21	4.81	6.98	1.95	5.47	*4.58*	

S.E. = subclinical edema

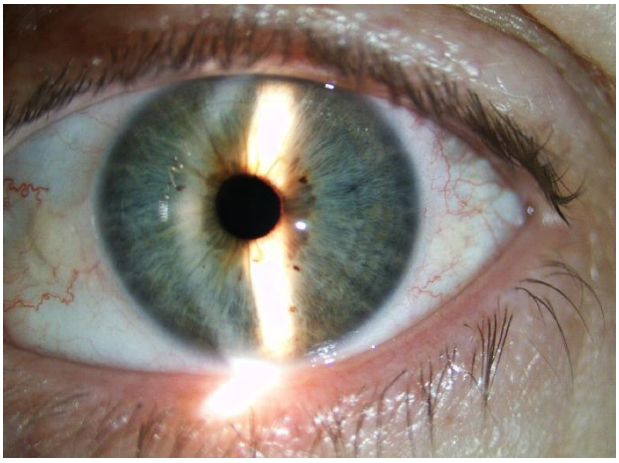

Fig. 1 Patients with Fuchs Corneal Endothelial Distrophy after Femtosecond laser – Assisted Cataract Surgery *(Casuistry LaserOptisan Clinic)*

Discussions

Few studies regarding Femtosecond Laser assisted cataract surgery in patients with FECD are mentioned in literature.

Szaflik (Szaflik J.P., unpulished data [2015]), Brundrett (Brundrett A., unpublished data [2015]) and Shukhaev (Shukhaev S., unpublished data [2015]) also reported insignificant changes in corneal thickness and endothelial cell density loss after Femtosecond Laser - Assisted Cataract Surgery in patients with FECD.

In studies regarding Phacoemulsification Cataract Surgery in patients with FECD, Yamazoe (2011) found a loss of 13.5% in Endothelial Cell density, while Hayashi (2011) noticed a loss from 779 cells/mm^2 before surgery to 766 cells/mm^2 endothelial cells after surgery [**4**] [**5**]. Seitzman (2005) noted an increase in central corneal thickness from 584 μm before surgery to 593 μm after surgery, while Hayashi (2011) noticed an increase of 3.3% μm after surgery [**5**] [**6**].

In our study, we obtained similar results in endothelial cell density and pachymetry before and after surgery, this differences being insignificant.

Regarding the amount of CDE used in Phacoemulsification Cataract Surgery differences between longitudinal and torsional phacoemulsification mode were noted. If a CDE of 24.37 ± 16.65 seconds is used in longitudinal phacoemulsification mode, in torsional phacoemulsification mode the CDE decreases to 11.45 ± 6.14 seconds (Doors M., unpublished data [2010]).

Our mean CDE was 4.58 seconds, much lower compared with the ones obtained in Phacoemulsification Cataract Surgery studies.

Conclusions

Insignificant increase in central corneal thickness and decrease in endothelial cell density was noticed after Femtosecond – Laser assisted cataract surgery in patients suffering from FECD enrolled in this study.

None of the patients developed clinically significant corneal edema after the surgery, just 2 of the patients had minor or moderate edema or corneal folds which disappeared in a few days.

Our data suggest that Femtosecond Laser - assisted cataract surgery can represent a safe alternative in patients with FECD and has a low risk of corneal decompensation, allowing excellent visual rehabilitation.

Although Femtosecond Laser - assisted cataract surgery seems to be safe in patients with FECD, a prospective randomized controlled study on a larger number of patients and with periodical follow-ups is required for validation of the results obtained in this analysis.

Discolsureses: none

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