Journal of Clinical & Experimental Ophthalmology
ISSN: 2155-9570

Halás Jr et al., J Clin Exp Ophthalmol 2012, 3:9
DOI: 10.4172/2155-9570.1000256

Research Article Open Access

Changes in Macula Lutea Following Nd: YAG Laser Capsulotomy in OCT Imaging

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Abstract

Objectives: To evaluate functional and anatomical changes in macular region after Nd:YAG capsulotomy.

Background: Optical coherence tomography (OCT) enables to visualize, compare and evaluate macular region of retina.

Method: 36 patients, 17 men and 19 women (40 eyes) with posterior capsule opacification underwent Nd:YAG capsulotomy. Average age was 78.2 ± 13 years. Day 1 after procedure and after 1 month best corrected visual acuity (BCVA), intra ocular pressure (IOP), foveal minimal thickness (FMT) and macular volume (MV) were evaluated. Diclophenacum natricum drops (Uniclophen 0.1%) for 3 weeks QID were administered.

Results: Average BCVA in day 1 was 0.71, median 0.50, after 1 month was 0.80, median 0.67. Average MFT in day 1 was 197.63 ± 10.3 μm, median 189 ± 9 μm and after 1 month was 189.63 ± 11.5 μm, median 184 ± 9 μm. Average IOP 15.41 torr, median 15 torr and after 1 month 15.72 torr, median 16 torr. Average MV in day 1 was 6.53 mm^3 and after 1 month was 6.51 mm^3.

Conclusion: Nd:YAG capsulotomy is safe method to remove posterior capsule opacification and improve BCVA. FMT and MV are sensitive parameters that correlate with BCVA. Changes in FMT and MV were nonsignificant.

Keywords: Nd:YAG capsulotomy; Macula; OCT; Macular volume; Macular thickness

Introduction

Uncomplicated cataract surgery with intra ocular lens (IOL) implantation cannot guarantee definitive and stable solution for permanent improving of visual acuity (VA). VA can decrease after certain period. Impairment of vision as a late result after cataract surgery can be due to various reasons (Cystoid macular edema (CME)–Irvine-Gass syndrome, retinal detachment, uveitis, TLS - toxic lens syndrome). One of the most frequent results of cataract surgery with IOL implantation is posterior capsule opacification (PCO)–secondary cataract.

Surgical method requires irrigation/aspiration (I/A) system to "clean" posterior capsule. This method is chosen when Elschnig pearls are present on the posterior capsule. Removing of cell aggregations from the posterior capsule will not get rid the patient of the problem completely because cells from periphery are able to return to the centre. Non invasive method is an alternative to surgical procedure Nd:YAG laser capsulotomy (Neodynium-Yttrium-Aluminium-Garnet - Nd:$Y_3Al_5O_{12}$) is a method using emitted energy from a crystal, that is bombed by Neodymium particles. The aim of Nd:YAG laser capsulectomy is to remove the secondary cataract by opening (by transfixion) the posterior capsule in centre. Energy pulses with wavelength of 1064 nm and flashes with duration of nanoseconds create a shockwaves effect (acoustic gradient) as well as a short thermic effect in place of focus. Because of acoustic wave is the posterior lens capsule opened by photo disruption of the tissue [1-3]. This effect is called noninvasive trauma with photochemical and ionising effect. The result is opening in the centre of posterior capsule with diameter cca 4 mm. The acoustic energy from the capsule is transmitted with vitreous to the retina trough adhered vitreous cortex. Energy from YAG laser capsulotomy can damage retinal [4] tissue by thermal photocoagulation and especially has influence on central part of retina by changing foveal minimal thickness (FMT) [1,5]. Turkish authors report a paper of long term follow up after Nd:YAG caplsulotomy without significant changes of foveal thickness [6].

With use of optical coherent tomography (OCT) we are able to measure FMT of the retina, visualize retinal layers, compare dynamic changes in macular region in time. The objective is to evaluate the influence of Nd:YAG laser energy on the central macula region–especially fovea and the impact on best corrected visual acuity (BCVA) and intra ocular pressure (IOP).

Methods

Our prospective study group included 36 patients, 17 male and 19 female (40 eyes) in average age 78.2 ±13 years with secondary cataract after uncomplicated cataract surgery. Group was treated with Nd:YAG capsulotomy. Inclusion criteria were slit lamp confirmed findings of fibrotic PCO, without presence of other pathological processes in the eye. Examination and procedure were performed on outpatient basis. Patient with dilated pupil were treated by Nd:YAG laser capsulotomy with "X" shaped opening of the posterior capsule. 10– 20 pulses were used to create 4 mm opening. After treatment patients administer Diclophenacum natricum eye drops QID for 3 weeks. 30 minutes after treatment stenopeic BCVA and IOP were examined. FMT and macular volume (MV) in 6 mm diameter were analysed with OCT (Stratus III,

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Received October 23, 2012; **Accepted** November 22, 2012; **Published** November 28, 2012

Citation: Halás M Jr, Svoreňova I, Krajčova P, Oláh Z, Strmeň P, et al. (2012) Changes in Macula Lutea Following Nd: YAG Laser Capsulotomy in OCT Imaging. J Clin Exp Ophthalmol 3:256. doi:10.4172/2155-9570.1000256

Carl Zeiss Meditec, USA). All patients were examined in the same day after Nd:YAG laser capsulotomy and one month after the procedure.

Data were statistically analysed with Students T test. Parameter $p<0.05$ was considered as significant.

OCT data before Nd:YAG capsulotomy were in the study not included because of low quality of acquired image signal due to PCO.

Results

Average BCVA immediately after Nd:YAG laser capsulotomy was 0.71 (median 0,50). One month after procedure was 0.80 (median 0.67). FMT immediately after treatment was 197.63 ± 10 μm, (median 189 μm), one month after procedure 189.63 ± 11 μm, (median 184 μm). Average IOP was 15.41 ± 2.5 torr (median 15 torr) and 15.72 ± 3 torr (median 16 torr) one month after. Average MV after treatment in 6 mm diameter was 6.53 ± 0.5 mm^3 (median 6.53 mm^3), after month 6.51 ± 0.44 mm^3 (median 6.51 mm^3). Used average energy for Nd:YAG capsulotomy was 72.35 ± 47.04 mJ , (median 62.53 mJ) (Table 1.)

Discussion

36 patients (40 eyes) with secondary cataract, after uncomplicated cataract surgery was included in this study. The question to answer was if laser energy used by Nd:YAG capsulotomy causes changes on posterior pole, especially in macula and foveola. Best corrected stenopeic visual acuity immediately after treatment was 0.71 ± 0.3, one month after procedure was 0.80 ± 0.2. BCVA one month after Nd:YAG capsulectomy shows significant improvement (p=0.011). Significant changes in BCVA are due to stenopeic measurement of BCVA at the day one and tyndallisation of PCO particles in anterior chamber. IOP was with no significant difference (15.41 ± 2.5 torr and 15.72 ± 3 torr, p=0.496). Average minimal foveal thickness in OCT imaging in day after procedure was 197.63 ±10 μm and decreased one month after treatment to 189.63 ± 11 μm. Macular volume values in day one were 6.53 ± 0.5 mm^3 and one month after 6.51 ± 0.44 mm^3 in average. Used average Ng:YAG energy was 72.35 mJ ± 47.04. OCT examination of the posterior pole in day one and one month later showed decrease of average FMT and average MV without statistically significant values in both parameters (p=0.141, p<0.817). BCVA changes did not correlate with changes in FMT and MV. Comparing our results with literature we came to similar results published in medical journals. Total average energy, number of laser shots or mean energy per shot did not affect the foveal thickness or macular volume [6].

	After procedure	After 1 month	Student´s t test
Average BCVA (Snellen)	0.71 ± 0.3	0.80 ± 0.2	p=0.011
Average IOP (torr)	15.41 ± 2.5	15.72 ± 3	p=0.496
Average MFT (μm)	197.63 ± 10	189.63 ± 11	p=0.141
Average MV (mm^3)	6.53 ± 0.5	6.51 ± 0.44	p=0.817

BCVA: Best Corrected Visual Acuity; IOP: Intra Ocular Pressure; MFT: Minimal Foveal Thickness; MV: Macular Volume

Table 1: Results after Nd:YAG laser capsulotomy (Nº of the eyes 40).

Conclusions

Nd:YAG capsulotomy is safe method for treatment of posterior capsule opacification. Foveal minimal thickness and macular volume are sensitive indicators that may correlate with BCVA. Nonsignificant changes in FMT and MV do not correlate with BCVA. In one month follow up in our study were no complications like retinal detachment, CME or increase of IOP in patients [7,8]. Patients continue follow up in our outpatients department.

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