ORIGINAL PAPER

doi: 10.5455/medarh.2019.73.109-112
MED ARCH. 2019 APR; 73(2): 109-112
RECEIVED: FEB 20, 2019 | ACCEPTED: MAR 24, 2019

Application of Vitamin E + Coenzyme Q Therapy During FAKO + IOL Implantation

Asim Kayiklik

Department of Ophthalmology, Adana Ortadogu Hospital, Adana, Turkey

Corresponding author: Asim Kayiklik, MD. Department of Ophthalmology, Adana Ortadogu Hospital, Adana, Turkey. E-mail: asimkayiklik@hotmail.com, Tel.: +905367143290. ORCID ID: http//www.orcid.org: 0000-0003-4301-1554

ABSTRACT

Introduction: Cataract surgery is a widely used procedure around the world. After cataract surgery, one of the important points is that oxidative stress may cause postoperative corneal edema and vision loss. **Aim:** In this study, we aim to reduce the oxidative stress and related conditions that may develop during intraoperative and postoperative FAKO + IOL implantation. **Material and Methods:** Total amount of 32 patients with cataract were included to the study. The patients were classified as two groups randomly and the same surgical procedure was applied to the patients in both groups, except using visudrop. Group I was defined as a control group and routine FAKO + IOL implantation surgery was performed. In Group II, after the sideport was opened at the beginning of the operation, 0.5 cc visudrop (coenzyme q + vitamin E + hypermellosis) was given to the anterior camara. After the operation, 0.5 cc visudrop was also given to the anterior camara. Postoperative examination findings were compared statistically. **Results:** In Group II, postoperative 1st day and postoperative 7th day visual acuities were significantly higher than in Group I. In Group II, postoperative 1st day and postoperative 7th day visual acuity increments were significantly higher than in Group I. In Group I, postoperative 1st day and 7th day pachymetry value increments were significantly higher than in Group II. **Conclusion:** Using visudrop during the FAKO + IOL implantation may be an effective method for postoperative corneal edema and vision.

Keywords: phacoemulsification, vitamin E, cataract, surgery.

1. INTRODUCTION

Cataract surgery is an operation which is very common everywhere in the world. On the other hand, according to the World Health Organization, cataract is in the second place among total causes of blindness. Many people are affected socially and psychologically due to the visual loss caused by this disease (1-5).

According to previous research, flavonoids, ascorbate, vitamin E, and pyruvic acid have been found to prevent cataract formation with antioxidative effects (2). Some animal studies have also shown that oxidative stress can cause cataract formation (6, 7). Coenzyme Q (CoQ) has also been reported to be among these antioxidants. CoQ is a kind of lipid which plays an important role in the maintenance of cellular energy balance. It is responsible for the transport of electrons in energy production in mitochondria (8). Studies with various animals have found that CoQ is an agent for the repair of neurodegenerative damage (9). For this reason, post-operative CoQ has been recommended for cell repair and iatrogenic injuries that may occur during surgery (10).

These results may show us that antioxidants should be used during advanced cataract surgery. It may reduce the risk of postoperative complications caused by oxidative stress and prevent the formation of corneal edema.

2. AIM

The aim of this study was to reduce the oxidative stress that may develop during intraoperative and postoperative FAKO + IOL implantation, to prevent postoperative corneal edema, and to improve the recovery time of the injury.

3. MATERIAL AND METHODS

This prospective clinical study was conducted between April 2017-April 2018 in the Ophthalmology Department of Adana Ortadogu Hospital. Approvals of all patients were obtained and the ethical approval was obtained from the Ethics Committee of Adana City Hospital in Adana in Turkey.

Totally, 32 patients with cataract (50-90 years of age) were included to the study. The patients with traumatic cataract, uveitis, and glaucoma were excluded from the study. Before and after the operation, the best corrected visual acuity (BCVA), eye pressure (To), biomicroscopic examination of anterior segment, and detailed fundus examination with cyclopentolate were performed to all patients. BCVA was evaluated with Snellen Chart. To was measured by applanation tonometry. Fundus examination was performed with the 90D lens. Corneal edema was measured by pachimetry.

The patients were classified as two groups randomly. There were 16 patients in Group I, and 16 patients in Group II. The same surgical procedure was applied to the patients in both groups, except using visudrop (coenzyme q + vitamin E + hypermellosis). Group I was defined as a control group and routine FAKO + IOL implantation surgery was performed. In Group II, after the sideport was opened at the beginning of the operation, 0.5 cc visudrop was given to the anterior camara of patients. After the operation 0.5 cc visudrop was also given to the anterior camara.

Operation process: At the beginning of the operation, tropicamide 0.5% and phenylephrine HCL 2.5% were instilled 3 times 5 minutes apart to the planned eye. Each patient was operated 45 minutes after the last drop. Proparakain HCL 0.5% was instilled to both eyes before the operation. The planned eye and surrounding area were wiped out with a 10% batikon. Patient covered with a drape. Eyelash bottoms and ocular surface were washed with 5% batikon and waited for 3 minutes. Peribulbar anesthesia was performed by administering 3 ml jetocaine to the subtenon area. The sideports were opened with a 20 Gauge knife. At the same time, unlike Group I, 0.5 cc visudrop was applied to the anterior camara of patients in Group II. After this stage, the same process was applied to the patients in both groups. Viscoelastic substance (VEM) was administered to the anterior camara. A corneal tunnel was opened with a 2.8 knife. Capsulorhexis and + hydrodissection were performed. The nucleus was phacoemulsified. Cortex residues were aspirated by bimanual irrigation and aspiration (I/A). The collapsible acrylic hydrophilic intraocular lens (IOL) was implanted into the capsule bag. The anterior camara was purged with I/A. 1 cc of 5.45 mg moxifloxacin was given to the anterior camara of patients. At the end of the operation, 0.5 cc visudrop was applied to the anterior camara of patients in Group II. All operations were terminated without complications.

After operation: All patients were advised to drop dexamethasone 1mg/mL drops 5 times a day, moxifloxacin 5.45 mg/mL drops 5 times a day, and nepafenac 1mg/mL drops 3 times a day for 3 weeks. BCVA, To, biomicroscopic examination of anterior segment, and detailed fundus examination were performed postoperatively. Follow-up was performed on postoperative 1st, 7th, and 21st days. The data obtained from the examinations was noted and compared statistically.

Statistical method: In the descriptive statistics of the data, mean, standard deviation, median lowest, highest, frequency and ratio values were used. The distribution of variables was measured with the Kolmogorov-Smirnov Test. Mann-Whitney U Test was used to analyze quantitative independent data. Wilcoxon Test was used for the analysis of dependent quantitative data. The Chi-Square Test was used for the analysis of qualitative independent data and the Fischer Test was used when the Chi-Square Test conditions were not provided. SPSS 22.0 program was used in the analysis.

4. RESULTS

General demographic findings and clinical characteristics of the sample are presented in Table 1.

		Min-Max	Median	Mean±SD/N%	
Age		50.00-90.00		64.2 ± 11.7	
Sex	Male			16	50%
	Female			16	50%
Eye	Right			16	50%
	Left			16	50%
Fundus	Abnormal			6	18.8%
	Normal			26	81.3%
To		13.0-24.0		17.7 ± 3.6	
Vo					
Preop		– 0.30	0.05	0.11 ± 0.10	
Postop Day-1		– 1.00	0.08	0.22 ± 0.31	
Postop Day-7		– 1.00	0.50	0.51 ± 0.34	
Postop Day-21		0.10 – 1.00	1.00	0.83 ± 0.29	
Pachimetry					
Preop		460.0 – 590.0	550.0	540.9 ± 31.6	
Postop Day-1		500.0 – 720.0	580.0	585.5 ± 53.0	
Postop Day-7		490.0 – 660.0	555.0	563.1 ± 41.5	
Postop Day-21		480.0 – 600.0	550.0	547.8 ± 34.1	
Biomicroscope	PSCC			6	18.8%
	CNC			6	18.8%
	NC +3			6	18.8%
	NC +4			6	18.8%
	NC+ PSCC			8	25.0%

Table 1. The demographic variables and clinical characteristics of the sample. PSCC: Posterior subcapsular cataract, CNC: Cortico-nuclear cataract; NC; Nuclear cataract.

Table 2 shows the comparison of Group I and Group II. In Group I and Group II, age and sex distribution were not significantly different (p>0.05). In Group I, the right eyes were significantly higher, and in Group II the left eyes were significantly higher (p<0.05). In Group I and Group II, intraocular pressure value did not differ significantly (p >0.05) (Table 2).

In Group I and Group II, visual acuity was not significant (p > 0.05) at preoperative and postoperative 21st days. In Group II, postoperative 1st day and postoperative 7th day visual acuities were significantly higher than in Group I (p < 0.05). In Group I, postoperative 1st day visual acuity decreased significantly (p <0.05). In Group I, postoperative 7th and 21st days visual acuities increased significantly compared to the preop period (p < 0.05). In Group II, postoperative 1st, 7th, and 21st days visual acuities increased significantly compared to the preop period (p <0.05). In Group II, postoperative 1st day and postoperative 7th day visual acuity increments were significantly higher than in Group I (p < 0.05). Post-

operative 21st day visual acuity did not show significant difference between the two groups (p> 0.05) (Table 2).

In Group I and Group II, preoperative, postoperative 1st day, postoperative 7th day, and postoperative 21st day pachymetry values did not differ significantly (p> 0.05). In Group I, postoperative 1st, 7th, and 21st days pachymetry values increased significantly compared to the preop period (p <0.05). In Group II, the postoperative first day, 7th day, and the 21st day pachymetry values increased significantly compared to the preop period (p<0.05). In Group I, postoperative 1st day and 7th day pachymetry value increments were significantly higher than in Group II (p <0.05) (Table 2).

		Group I			Group II			p
		Mean±SD/N%		Median	Mean±SD/N%		Median	
Age		64.0 ± 11.7			64.4 ± 12.0			0.880
Sex	Male	8	50%		8	50%		1.000
	Female	8	50%		8	50%		
Eye	Right	12	75.0%		4	25.0%		0.005
	Left	4	25.0%		12	75.0%		
Fundus	Abnormal	3	18.8%		3	18.8%		1.000
	Normal	13	81.3%		13	81.3%		
To		17.5 ± 3.6			17.9 ± 3.8			0.983
Vo								
Preop		0.11 ± 0.10		0.08	0.11 ± 0.11		0.05	0.969
Postop Day-1		0.07 ± 0.06		0.05	0.38 ± 0.37		0.30	0.003
Postop Day-7		0.37 ± 0.30		0.30	0.64 ± 0.34		0.65	0.021
Postop Day-21		0.81 ± 032		1.00	0.86 ± 0.26		1.00	0.836
Difference with Preop								
Postop Day-1		-0.05 ± 0.08		-0.03	0.27 ± 0.30		0.13	0.000
Intra Group Dif.		0.025			0.002			
Postop Day-7		0.26 ± 0.26		0.20	0.53 ± 0.28		0.56	0.009
Intra Group Dif.		0.001			0.000			
Postop Day-21		0.70 ± 0.29		0.80	0.74 ± 0.24		0.80	0.835
Intra Group Dif.		0.000			0.000			
Pachimetry								
Preop		537.3 ± 36.4		547.5	544.5 ± 26.7		550.0	0.637
Postop Day-1		600.3 ± 61.3		590.0	570.6 ± 39.6		567.5	0.249
Postop Day-7		570.0 ± 48.9		555.0	556.3 ± 32.7		555.0	0.520
Postop Day-21		546.9 ± 39.6		550.0	548.6 ± 28.9		555.0	0.910
Difference with Preop								
Postop Day-1		63.0 ± 56.5		45.0	26.1 ± 27.2		17.5	0.045
Intra Group Dif.		0.001			0.001			
Postop Day-7		32.7 ± 36.2		15.5	11.8 ± 15.6		5.0	0.048
Intra Group Dif.		0.001			0.003			
Postop Day-21		9.6 ± 11.6		5.0	4.1 ± 5.4		2.0	0.200
Intra Group Dif.		0.003			0.007			

Table 2. The comparison of Group I and Group II.

5. DISCUSSION

Corneal edema is known to be the most common postoperative complication of phacoemulsification (11-15). On the other hand, corneal edema is also reported to be the most common cataract surgery complication that affects early vision (16). The anterior segment surgery applied to the eye due to cataract causes iatrogenic damage in the cornea which cause the changes on the eye surface. As a result, corneal edema and vision loss may develop (10). Corneal nerves form a set of defense mechanisms to prevent damage to the cornea. They also provide feedback by stimulating tear secretion (12). Thanks to this mechanism, the histological and physical structure of the cornea is preserved. In a case report, four months after cataract surgery SSB has been found to be renewed (15). In the study of Paolo Fogagnolo et al., nerve regeneration, which is normally 9 months, has been shown to occur with CoQ in 3 months (10). In the light of this data, CoQ can be used to prevent early complications of phacoemulsification.

Vitamin E d-α-tocopheryl polyethylene glycol 1000 succinate (Vitamin E TPGS or TPGS) is synthesized by esterification of Vitamin E succinate with polyethylene glycol (PEG) 1000. It is a naturally water-soluble form of Vitamin E. TPGS has the effect of enhancing the bioavailability of excellent solubilizers and hydrophobic drugs (17). It is a strong antioxidant. Furthermore, TPGS has a slowing effect on the production of energy in the mitochondria, thus it can reduce the formation of free radicals and decrease the oxidative stress levels (18). Since the inflammation will decrease when the oxidative stress decreases, the regeneration of corneal damage with CoQ will be easier and the cornea will recover and gain transparency in a shorter time. This will eliminate the corneal edema and early stage vision loss.

6. CONCLUSION

According to our study findings, we saw that Vitamin E + CoQ combination were effective for corneal edema and vision loss after cataract surgery. Corneal edema and vision improved faster with no adverse effects in patients who were applied visudrop solution. These findings should be supported by long-term studies with large samples. We believe that this study will guide the future research.

- **Declaration of patient consent:** The author certify that he have obtained all appropriate patient consent forms.
- **Author's contribution:** Author gave substantial contribution to the conception or design of the work and in the acquisition, analysis and interpretation of data for the work. Author had role in drafting the work and revising it critically for important intellectual content. Author gave final approval of the version to be published and he agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. Author collected data, made literature search and drafted the manuscript. The final version has been read and approved by the author.
- **Conflicts of interest:** There are no conflicts of interest.
- **Financial support and sponsorship:** None.

REFERENCES

1. Jaffe NS, Jaffe MS, Jaffe GF. Cataract surgery and its complications. ST: Louis, C.V Mosby Co. 1990; 259-280.
2. Varma SD, Ets TK, Richards RD. Protection against superoxide radicals in the rat lens. Ophthalmic Res. 1977; 9: 421-423.
3. Kowluru RA, Kern TS, Engerman RL, Arm- strong D. Abnormalities of retinal metabo lism in diabetic rat and experimental galac tosemia. 3. Effect of antioxidant diets. Diabetes. 1996; 45: 1233-1237.
4. Resnikoff S, Pascolino D, Etya'ale D, Kocur I, et al. Global data on visual impairment in the year 2000. Bull World Health Organ.2004; 82: 844-851.
5. Chandra P, Hegde KR, Varma SD. Possibility of Topical Antioxidant Treatment of Cataracts: Corneal Penetration of Pyruvate in Humans. Ophthalmologica. 2009; 223: 136-138.
6. Hegde KR, Varma SD. Prevention of cataract in experientially diabetic mice. Mol Cell Biochem. 2005; 269: 115-120.
7. Creighton MO, Ross WM, Stewart-DeHaan PJ, Sanwal M, Trevithick JR. Modelling cortical cataractogenesis. 7. Effects of vitamin E treatment on galactose-induced cataracts. Exp Eye Res. 1985; 40: 213-222.
8. Ernster L, Dallner G. Biochemical, physiological and medical aspects of ubiquinone function. Biochim Biophys Acta. 1995; 1271: 195-204.
9. Matthews RT, Yang L, Browne S, Baik M, Beal MF. Coenzyme Q10 administration in- creases brain mitochondrial concentrations and exerts neuroprotective effects. Proc Natl Acad Sci USA. 1998; 95: 8892-8897.
10. Fogagnolo P, Sacchi M, Ceresara G, Paderni R, Lapadula P, Orzalesi N, Rossetti L. The Effects of Topical Coenzyme Q10 and Vitamin E D-□-Tocopheryl Polyethylene Glycol 1000 Succinate after Cataract Surgery: A Clinical and in vivo Confocal Study. Ophthalmologica. 2013; 229: 26-31.
11. Muller LJ, Marfurt CF, Kruse F, et al. Corneal nerves: structure, contents and function. Exp Eye Res. 2003; 76: 521-542.
12. Dartt DA. Dysfunctional neural regulation of lacrimal gland secretion and its role in the pathogenesis of dry eye syndromes. Ocul Surf. 2004; 2: 76-91.
13. Perez-Santonja JJ, Sakla H, Cardona C, et al. Corneal sensitivity after photorefractive keratectomy and laser in situ keratomileusis for low myopia. Am J Ophthalmol. 1999; 127: 497-504.
14. Martin XY, Safran AB: Corneal hypoesthesia. Surv Ophthalmol. 1988; 33: 28-40.
15. Babu K, Narasimha Murthy K, Ramachandra Murthy K. Wave-like epitheliopathy after phacoemulsification: role of in vivo confocal microscopy. Cornea. 2007; 26: 747-748.
16. Feray Koç, Ihsan Oge, Dilek Erkan, Nurşen Arıtürk, Yüksel süllü. Fakoemülsifikasyona geçişte komplikasyonlar. T Oft Gaz. 2000; 30: 279-287.
17. Guo Y, Luo J, Tan S, Otieno BO, Zhang Z. The applications of Vitamin E TPGS in drug delivery. Eur J Pharm Sci. 2013; 49: 175-186.
18. Assanhou AG, Li W, Zhang L, Xue L, Kong L, Sun H. et al. Reversal of multidrug resistance by codelivery of paclitaxel and lonidamine using a TPGS and hyaluronic acid dual-functionalized liposome for cancer treatment. Biomaterials. 2015; 73: 284-295.