Evaluation of the Effect of Pterygium on Phacoemulsification Surgery

Ozkan SEVER[1]

ABSTRACT

Purpose: The aim of this study is to compare the effect of phacoemulsification surgery on cornea in eyes with pterygium, with operated pterygium and without pterygium.

Material and Methods: This study included 60 eyes of 60 patients who were followed-up between 2010 November and 2016 September at Namik Kemal University Research Hospital. Mean age of the patients was 67 (50-74) years. Twenty-nine of patients were male 31 of patients were female. Groups consisted 20 patients who had cataract without pterygium, 20 patients with cataract and pterygium and 20 patients with cataract and operated pterygium. All of the patients had grade 4 or 5 nuclear cataracts according to Lens Opacity Classification System III (LOCS III). Mean follow up time, central corneal thickness (CCT), endothelial cell density (ECD), ultrasound time, phaco time, used total balanced salt solution, percentage total equivelant power in position 3 (%TEPiP3) and best corrected visual acuity (BCVA) were recorded.

Results: Each group included 20 patients (20 eyes). Three months postoperatively, the mean BCVA for all groups was 0.013 logMAR or better and the mean CCT returned to the preoperative levels for with-pterygium, operated pterygium and without pterygium group (P=.730, P=.703 and P=.648, respectively). At postoperative 3 month, endothelial cell loss of the patients with pterygium was significantly higher than other two groups (P=0.03).

Conclusion: The eyes with pterygium are more susceptible to the corneal parameter changes caused by cataract surgery compared to eyes with no pterygium or the ones with history of pterygium surgery.Planning a pterygium surgery prior to cataract surgery might decrease the postoperative corneal problems.

Keywords: Pterygium, Cornea, Cataract.

INTRODUCTION

It could be safely assumed that as the society gets older so does the number of cataract patients.[1] According to 2010 National Eye Institute(NEI) datas the number of cataract patients in the U.S is expected to be doubled from 24.4 million to about 50 million by 2050. Such an increase will also bring a higher demand for cataract surgery. Today, it is widely accepted that the most frequent surgical method used for cataract surgery is phacoemulsification.[2] The purpose of phacoemulsification surgery is to aspirate lens using low ultrasonic energy, to protect the surrounding tissues from the thermal and fluidic effects using a smaller corneal incision.[3]

Pterygium is a degenerative, hyperelastatic and hyperplastic disorder begining with a fibrovascular proliferation of bulbar conjunctiva and corneal invasion.[4,5] In the coincidence of both pterygium and cataract, which surgery is more appropriate and needs to be performed initially is subject for controversy.

In this study we took this as a central problem and evaluated the effect of pterygium presence on corneal parameters during phacoemulsification surgery.

MATERIAL AND METHODS

Patients form a tertiary health center between November 2015 and March 2016 were included in this prospective controlled clinical study. Informed consent was taken from all patients. Institutional review board approval was obtained from the local ethical committee of the same center.

1- Assistant Prof., Ophtalmogy Department of Namik Kemal University, Tekirdag, Turkey

Received: 28.08.2019
Accepted: 17.09.2019
Glo-Kat 2020; 15: 13-18
DOİ: 10.37844/glauc.cat.2020.15.3

Correspondence Adress:
Ozkan SEVER
Namik Kemal University, Tekirdag, Turkey

Phone: +90 282 250 5186
E-mail: sever_ozkan@hotmail.com

Patients were divided into 3 groups. Group 1 constituted 20 patients with cataract and no pterygium, Group 2 constituted 20 patients with cataract and a history of pterygium surgery and Group 3 constituted 20 patients with cataract and pterygium. Inclusion criteria were; Grade 4-5 nuclear cataract according to Lens Opacities Classification System III (LOCSIII), endothelial cell density (ECD) higher than 1800 cells/mm^2, nasal pterygium with a head part over cornea between 1.5 to 2.5, operated pterygium patients without any residue on cornea and age older than 65 years. Exclusion criteria were glaucoma, uveitis, high myopia, dilated pupil size less than 6 mm, pseudoexfoliation, diabetic retinopathy, senile macular degeneration, pterygium more than 2.5 mm and corneal pathologies such as; Fuchs' and congenital endothelial dystrophy.

Mean time from pterygium surgery to phacoemulsification surgery for Group 2 was 2.3±1.1 years. All pterygium surgeries were made using a conjunctival autogreft without using any antimitotic agent during surgeries.

All patients had complete ophthalmic examination including slit lamp microscopic evaluation, central corneal thickness (CCT) measurement (Pascan 300P, Sonomed, Inc.), best corrected visual acuity (BCVA) (with Snellen charts). A non-contact specular microscopy was used to measure central ECD (SP-01, Costruzione Strumenti Oftalmici) preoperatively and postoperative 1 month and 3 month.

CCT measurements were performed preoperatively, post-operative 1 day, 1 month and 3 month. Pre-operative and post-operative ECD measurements for Group 1 and 2 was automatically measured but ECD measurements of Group 3 was performed manually for at least 40 adjacent cells.

All surgeries were performed by same surgeon. Before operations 3 times at 5 minutes intervals procaine hydrochloride (Novocain, Alfred Einhorn,Germany) was dropped for local anesthesia. 2.8 mm clear corneal incisions were made superotemporally and two 20-G MVR incision on 10 and 4 o'clock. Continuous 6 mm capsulorhexis was achieved and after hydrodissection the standard surgery used for groups was torsional quick chop method (Ozil IP, Alcon Laboratories, Inc.). Cortex and OVD were cleaned by irrigation\aspiration cannula (Alcon Lab.). Corneal endothelial protection was achieved by Ophthalmic Viscoelastic Device (OVD) (sodium hyaluronate [Microvisc 1.4%]. All corneal incisions were closed with stromal hydration and moxifloxacin was administered to anterior chamber. Topical moxifloxacin and prednisolone acetonide were reciped for at least 2 weeks 4 times a day.

STATISTICAL ANALYSIS

Independent-sample t test, paired sample t test and lineer regression analysis were used to measure the differerences between groups. Anova correlation was used for relationship between groups. P values lower than 0.05 was accepted as statistically significant.

RESULTS

Each group included 20 patients (20 eyes). There were no statistically significant differences in terms of age, sex, operated eye or nuclear opacification grade among the groups (P=0.58) (Table 1).

No complications occurred during or after surgery. There were no cases of phaco burn of the corneal incision. There were no significant between-group-differences in the CCT measurements preoperatively (P=0.316) and postoperative 3 month (P=0.916). However postoperative first day 5 CCT measurements of Group 3 could not be able to be measured because of severe corneal edema. There was no statistically significant difference in the mean BCVA between groups at postoperative 3 month (P=0.717) (Table 2).

The postoperative BCVA at 3 month was 0.096 logMAR or better in all eyes. At 1 month and 3 month, the endothelial cell loss exceeded 25% in Group 3. First month the ECL exceeded for Group 3 was greater than 3 month as it was statistically significant (P=0.039, P=0.087 respectively. Group 1 and 2 had at most 15% ECL and that was not statistically significant (P=0.318) Although cumulated dissipated energy (CDE) used in Group 3 was higher than other groups it was not statistically significant(p=0.137). Table 3 shows the correlations between the intraoperative power, ECL after surgery and fluidics for all surgeries.

The preoperative and postoperative first month ECL was statistically significant between groups (P=0.021) and 3 month ECL was insignificant (p=0.079).

DISCUSSION

To our knowledge, this is the first study to compare the effect of pterygium on corneal parameters during phacoemulsification surgery. The aim of our study was to evaluate the effect of pterygium on corneal parameters like; postoperative ECL, CCT and BCVA alterations for patients with similar cataracts (moderate to hard) and endothelial cell density. In an attemp to minimize all external effects on surgery except pterygium, all surgeries were made under topical anesthesia by the same surgeon, technique, viscoelastic device, BSS solution and intraocular lens.

Table 1. *Patient characteristics and preoperative features of groups.*				
	Groups			
Parameters	**With-Pterygium (n=20)**	**With-Operated Pterygium(n=20)**	**Without Pterygium (n=20)**	**P value**
Sex,n Male Female	 12 (60%) 8 (40%)	 11 (55%) 9 (45%)	 10 (50%) 10 (50%)	p>0.05
Eye,n Right Left	 9 (45%) 11(55%)	 12 (60%) 8 (40%)	 7 (35%) 13 (65%)	P>0.05
Age (year) Mean±SD Range	 61.2 (±5,8) 52-71	 60.8 (±5,5) 50-68	 62.2 (±5.0) 53-74	p>0.05
IOP (mmHg) Mean±SD Range	 13.5 (±2.9) 9-19	 13.1(±3.1) 9-20	 11.2(±2,7) 10-16	p>0.05
Nuclear Grade Grade 4 Grade 5	 18 (90%) 2 (10%)	 17(85%) 3(15%)	 19(95%) 1(5%)	p>0.05
IOP: Intraocular Pressure, p > 0,05 is accepted insignificant				

Table 2. *Comparisons of preoperative and postoperative parameters between groups.*							
	With-pterygium		**Operated Pterygium**		**Without pterygium**		**P value**
Parameters	**Mean±SD**	**Range**	**Mean±SD**	**Range**	**Mean±SD**	**Range**	
VA							
Preoperative	0.25±0.12	0.1-0.5	0.24±0.11	0.1-0.4	0.24±0.11	0.1-0.5	0.901
Postoperative							
3 month	0.97±0.5	0.8-1.0	0.97±0.5	0.8-1.0	0.97±0.5	0.8-1.0	0.816
CCT (µm)							
Preoperative	554±24.2	505-554	553±27.7	506-553	555±29.2	503-555	0.316
Postoperative							
1 month	558±17.7	534-587	547±24.7	500-601	543±25.1	523-579	0.802
3 month	556±14.8	543-600	557±22.7	521-598	557±19.6	523-600	0.951
ECD(cell/mm^2)							
Preoperative	2168±163	1980-2543	2115±128	2000-2500	2101±110	1980-2432	0.854
Postoperative							
1 month	1610±241	1240-2000	1849±172	1569-2100	1820±119	1569-2003	0.021
3 month	1652±243	1200-2003	1813±160	1550-2090	1794±108	1570-1980	0.079
ECL(cell/mm^2)							
1 month	810±111 (26%)	400-900	530±81 (21%)	240-790	310±111 (17%)	202-685	0.021
3 month	805±131 (23%)	300-856	520±56 (19%)	190-780	260±131 (16%)	180-650	0.079
VA: Visual Acuity, **CCT**: Central Corneal Thickness, **ECD**: Endothelial Cell Density, Anova tests p<0,05 is significant							

Pterygium surgery has more than 200 hundred years of history although modern techniques has been adopted after 1940s. After the introduction of bare sclera technique there has been lots of techniques defined like; conjunctival autograft (still the most used and efficient technique), conjunctival fleps, amnion graft use, fibrin glue technique and adjacent agent used techniques (mitomycin C, 5-flourouracil, topical bevacizumab).[6,7] For pterygium the most appropriate way of treatment is still surgery for most cases.[8] Nevertheless, the techniques we mentioned above have got various early side effects; bleeding, hematoma, loose sutures, corneal scarring, as well as late side effects such as; recurrence, scleromalasia, conjunctival necrosis, tenon cysts, corneal perforation, diplopia, adjunct therapy related complications and symblepharon.[9] The most common late side effect is recurrence and for bare sclera technique the recurrence rate is as high as 50% but for the others recurrence varies from 0.003% to 40.9.[10-12] These high recurrence rates sometimes enforce both doctors and patients to consider conservative methods other than surgery such as; topical steroids and artificial tear-drops.

The most important reason for pterygium surgery is decreased vision from encroachment of pterygium to visual axis or pterygium induced astigmatism, Min-Yen et al. showed that long-time pterygium presence caused a decrease in ECD; in the future this might be a new indication for pterygium surgery.[5] Also Buratto et al. reported that advanced pterygium has got nasal canthal adhesions thus resulting in fine Descement strias, especially when looking temporally.[13] This tangential traction might be one other reason for ECL during phacoemulsification surgery.

Mean ultrasound power used through surgery has got a positive correlation with nuclear density of cataracts.[14] Thus especially high density nuclear cataracts grade 4-5 or more are much more vulnerable to ECL. We chose our patients with high nuclear cataracts to determine the endothelial effects of pterygium surgery more clearly. Soft cataracts sometimes don't need phaco power and this might mascerade the effect of phacoemulsification surgery in patient with pterygium. On the other hand we did not only want to evaluate the effect of pterygium for tangential traction but also corneal stromal tissue invasion was another important problem. In this study mean ultrasound time and power of Group 3 were high but there was no significant difference between groups.

Table 3. *Intraoperative parameters.*

	Phacoemulsification Method			
Parameters	**With Pterygium**	**Operated Pterygium**	**Without pterygium**	**P value**
Ultrasound time (sec)				
Mean±SD	62.1±38.5	59.5±35.1	56.5±31.2	0.224
Range	17-219	18-190	16-175	
Phaco time (sec)				
Mean±SD	14.9±23.2	10.9±9.7	8.9±7.7	0.212
Range	0.4-110	0.3-34.4	0.1-44.4	
Torsional time (sec)				
Mean±SD	53.6±24.2	49.3±37.9	46.3±30.9	0.204
Range	12-100	7-179	12-132	
Cumulative Dissipated Energy				
Mean±SD	14.1±10.9	11.9±8.3	9.9±8.7	0.137
Range	1.7-62.3	1.4-29.6	1.1-20.8	
%TEPiP3				
Mean±SD	16.1±5.7	14.8±5.1	15.8±2.1	0.039
Range	5.5- 27.2	8.2-32.0	7.7-30.0	
Balanced Salt Solution Volume (mL)				
Mean±SD	74.4±31.1	71.1±34.9	69.0±32.6	0.689
Range	48-209	33-210	23-200	

%TEPiP3, Percentage total equivelant power in position 3

This study revealed that the cataract patients with similar endothelial cell densities and similar grade cataracts were significantly effected from pterygium during phacoemulsification surgery. Patients in Group 1 and 2 were similar with regards to ECD. On the other hand Group 3 had significantly lower ECD in comparison to other groups. Especially postoperative first day ECL of Group 3 was about 25% and this shows that these patients are at risk of corneal decompensation. Patients, who have both cataract and pterygium, with corneal endothelial problems like, Fuchs' endothelial dystrophy, should be carefully evaluated for corneal decompensation. Because we carefully evaluated and measured the ECD for all patients before surgery no corneal decompensation happened. Thus ECLs didn't effect the postoperative BCVA (first and third month BCVAs between groups were similar) (p=0.717).

In 2005 Lundberg et all. reported that increment in early central corneal thickness is a strong sign for ECL at 3 month.[15] Matching with this study, CCT for Group 3 was significantly higher from both other groups at 1 day but similar at 1 month and 3 months . ECL at first month was statistically significant (p=0.021) and 3 month was almost statistically significant (p=0.079) between groups that Group 3 had more ECL than both other groups .

Patients with pterygium should be carefully evaluated for ECL, especially in corneal endothelial problems. We speculate that, visualization problems, stromal penetration of pterygium tissue and tangential tractions altogether might be reasons for more ECL. This study suggests for the studies concerning the evaluation of relation between phacoemulsification surgery and ECD that patients who have pterygium more than 1.5-2 mm ought to be carefully evaluated to make ECL statistics in studies. On the other hand as to compare the surgical experiences we should note that phacoemulsification surgery of patients with pterygium makes the surgery more complicated because of visualization problems, especially at the capsulorhexis phase. Using a small group of patients is the major limitation of our study. Thus prospective studies with larger groups would have the potential of developing and confirming the results of this study for further discussion. In conclusion visualization problems, tangential traction by pterygium tissue or stromal invasion of pterygium tissue makes phacoemulsification surgery more vulnerable to ECL.

Conflict of interest: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

REFERENCES

1. Klein BE, Klein R, Lee KE, et al. Incidence of age-related cataract over a 15-year interval the Beaver Dam Eye Study. Ophthalmology. 2008;115:477-82
2. Leaming DV. Practice styles and preferences of ASCRS members-1994 survey. J Cataract Refract Surg 1995; 21:378-87.
3. Gonen T, Sever O, Horozoglu F, et al. Endothelial cell loss: Biaxial small-incision torsional phacoemulsification versus biaxial small-incision longitudinal phacoemulsification. J Cataract Refract Surg. 2012;38:1918-24.
4. Dushku N, John MK, Schultz GS, et al. Pterygia pathogenesis: corneal invasion by matrix metalloproteinase expressing altered limbal epithelial basal cells. Arch Ophthalmol. 2001;119:695-706.
5. Hsu MY, Lee HN, Liang CY, et al. Pterygium is related to a decrease in corneal endothelial cell density. Cornea. 2014; 33:712-5
6. Motarjemizadeh Q, Aidenloo NS, Sepehri S. A comparative study of different concentrations of topical bevacizumab on the recurrence rate of excised primary pterygium: a short-term follow-up study. Int Ophthalmol. 2016;36(1):63-71
7. Sheppard JD, Mansur A, Comstock TL, et al. An update on the surgical management of pterygium and the role of loteprednol etabonate ointment. Clin Ophthalmol. 2014; 13;8:1105-18.
8. Andreoli CM, Miller JW. Anti-vascular endothelial growth factor therapy for ocular neovascular disease. Curr Opin Ophthalmol 2007; 18(6):502-8.
9. Kumar DA, Agarwal A. Pterygium: postoperative management and complications. In: Hovanesian JA, editor. Pterygium: Techniques and Technologies for Surgical Success. Thorofare, NJ: Slack Incorporated; 2012:111-20.
10. Hirst LW. Recurrence and complications after 1,000 surgeries using pterygium extended removal followed by extended conjunctival transplant. Ophthalmology 2012;119:2205-10
11. Chen PP, Ariyasu RG, Kaza V, et al. A randomized trial comparing mitomycin C and conjunctival autograft after excision of primary pterygium. Am J Ophthalmol 1995;120:151-60
12. Tananuvat N, Martin T. The results of amniotic membrane transplantation for primary pterygium compared with conjunctival autograft. Cornea 2004; 23:458-63
13. Buratto L, Phillips RL, Carito G. Symptoms. In: Buratto L, Phillips, Carito GC, (eds). Pterygium Surgery. Slack: Thorofare, 2000, pp 29-32.
14. Bozkurt E, Bayraktar S, Yazgan S, et al. Comparison of conventional and torsional mode (OZil) phacoemulsification: randomized prospective clinical study. Eur J Ophthalmol 2009;19:984-9
15. Lundberg B, Jonsson M, Behndig A. Postoperative corneal swelling correlates strongly to corneal endothelial cell loss after phacoemulsification surgery. Am J Ophthalmol. 2005;139:1035-41.