

Alteration of Tear Film after Vitrectomy and its Influencing Factors

Touka Banaee, MD,¹ Hamid Gharaee, MD,¹ Mohammad Khajeh Daluee, MD²
Saeed Shokoohi-Rad, MD,³ Majid Abrishami, MD⁴

Abstract

Purpose: To detect the prevalence of dry eye after vitrectomy and its influencing factors.

Methods: Schirmer I, Tear Basic Secretion Test and Tear Breakup Time was done preoperatively and 3 months postoperatively on consecutive patients undergoing vitrectomy in Khatam Hospital from 2005 to 2006. Eyes with previous peritomies of more than 120° and symptoms of dry eye or tear tests compatible with a diagnosis of dry eye were excluded. Intraoperative factors including the extent of peritomy, extent of inadvertent conjunctival lacerations, extent of scleral depression and the instrument used for scleral depression were recorded. Scleral depression was graded extensive if it was done for more than 180° of globe circumference.

Results: Seventy five eyes of 75 patients were studied. Forty six (61.3%) of patients were male. The mean age of the patients was 47.13±18.85 years. Peritomy size was on average 179.33°±124.75 and the mean size of conjunctival ruptures was 2.18±4.33 mm. Based on the type of instrument used for scleral depression, patients were divided into 4 groups: 1) metallic instrument, 6 cases (8%) 2) cotton applicator, 32 cases (42.7%) 3) both, 14 cases (18.8%) 4) none (no scleral depression), 23 cases (30.7%). Of 52 cases with scleral depression, the depression was extensive in 35 cases (46.7% of all eyes). Thirteen eyes (17.3%) developed tear film parameters or symptoms consistent with dry eye. All of these eyes had undergone extensive scleral depression. Cotton applicator had been used significantly more in cases which developed dry eye. There was a direct relation between extent of peritomy and inadvertent conjunctival laceration and development of dry eye.

Conclusion: Due to damage to the conjunctiva during operation, vitrectomy is apt to cause dry eye. To lower the risk of this complication, scleral depression, peritomy and possibility of inadvertent conjunctival lacerations should be minimized. It is also better to use metallic instruments for scleral depression rather than cotton applicator.

Keywords: vitrectomy, dry eye, complication, scleral depression, peritomy

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1. Assistant Prof. of Ophthalmology, Ophthalmic Research Center, Khatam-Al-Anbia Hospital, Medical Sciences/University of Mashhad
 2. Assistant Prof. of Social Medicine, Qaem Hospital, Medical Sciences/University of Mashhad
 3. Resident in Ophthalmology, Ophthalmic Research Center, Khatam-Al-Anbia Hospital, Medical Sciences/University of Mashhad
 4. Professor of Ophthalmology, Ophthalmic Research Center, Khatam-Al-Anbia Hospital, Medical Sciences/University of Mashhad

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Correspondence to:
Touka Banaee, MD
Ophthalmic Research center,
Khatam-Al-Anbia Hospital, Mashhad
Tel: +98 511 7281401
Email: tk_banaee@yahoo.com

Introduction

Dry eye is a common ophthalmologic problem and 10-15% of adults suffer from it.¹

This disease results from a decrease in tear production or increase in tear film evaporation. The deepest layer is mucin, and is secreted by goblet cells and can be affected by chemical burns, cicatricial pemphigoid, Stevens Johnson syndrome, trachoma and conjunctival trauma (including surgical trauma).¹

During pars plana vitrectomy, conjunctiva is traumatized specially if scleral depression is used for surgery in the region of the vitreous base. A previous study confirmed the morphological changes of the conjunctiva after this type of surgery^{1,14} but we are unaware of any study reporting the frequency of resultant dry eye after vitrectomy. The aim of this study was to investigate both symptoms of dry eye and the tear film changes after vitrectomy.

Methods

Seventy five consecutive patients undergoing standard three ports 20 gauge pars plana deep vitrectomy from April 2005 to December 2006 were studied. Patients with dry eyes, symptoms of dry eye or abnormal tear film tests consistent with dry eye (see below) and patients with history of peritomy more than 120 degrees in previous ocular surgeries were excluded. The limit of acceptable previous conjunctival peritomy was set at 120 degrees in order not to exclude cases of pseudophakic RD with history of extracapsular cataract extraction.

Each patient underwent tear film testing including tear break up time, tear basic secretion test (TBST) and Schirmer I test before surgery. Instillation of eye drops and conjunctival manipulations were avoided at least 30 minutes before these tests.

Schirmer I test was done as follows: a strip of Dina Strip was inserted in the lower conjunctival cul de sac in the junction of the lateral and middle thirds of the lower lid for 5 minutes. To decrease the effect of blinking on the test the eyes were closed during the test. Wetting less than 10 mm was considered abnormal.

Then TBST was done by instillation of anesthetic drop (Tetracaine) and maintaining the aforementioned standards. Less than

5 mm was considered dry eye. Then Tear Breakup Time (TBUT) was carried out after placing fluorescein in the lower cul de sac, and then examining the tear film. After a few blinks, the tear film was examined by blue filter on slit lamp. The time between last blinking to the first color free spot on the cornea was measured by chronometer. Less than 10 sec was considered dry eye. This is a valuable test in evaluating the mucin layer.

These tests were carried out by residents of ophthalmology and trained optometrists. If test results were consistent with a diagnosis of dry eye, then the patient would be excluded from the study.

These data plus demographic information, history of previous ocular surgeries, diabetes mellitus and drug history was recorded.

Then vitrectomy was done and intraoperative interventions such as: the extent of scleral depression and the type of instrument used for this purpose, the extent of peritomy and unwanted conjunctival lacerations were recorded by the surgeon. These factors were determined by preference of the surgeon and none were randomized. Extended peritomy and scleral depression were used for surgical maneuvers in the region of the vitreous base like vitreous base trimming, dissections, and photocoagulation.

Scleral depression of more than 180 degrees around globe circumference was considered extended and depression of less than 180 degrees was considered as being limited.

Three months after vitrectomy, the patients were asked about the presence of symptoms consistent with dry eye including dryness, foreign body sensation, burning and tearing in the operated eye. Then the tear film tests mentioned before were carried out.

Scleral depression more than 180 degree was considered extended and less than that, local. The instrument for scleral depression (cotton applicator or indentation-related metal instrument) was also recorded.

The extent of peritomy, the instrument used and the extent of scleral depression were selected according to the surgeon's preference and patient's condition. Then the patient was followed and after 3 months, the pre-op tests were repeated and dry eye symptoms were recorded.

Data Analysis and Statistical Methods

For description of data, one and two dimensional tables (including prevalence and relative prevalence) were used. To study the relation between factors influencing the tear film, we used χ^2 and paired *t*-test.

For data analysis confounding factors were omitted.

Results

Seventy five patients were included, 46 (61.3%) being male. Patients were from 4 to 80 years (mean: 47.13, SD :18.85). Twenty one (28%) suffered from Diabetes.

Major indications for vitrectomy were: retinal detachment in 36 cases and proliferative diabetic retinopathy (PDR) in 21 cases. Other indications included presence of intraocular foreign body, vitreous hemorrhage and endophthalmitis.

Results of preoperative and postoperative tear film tests are presented in Table 1.

Scleral buckling was done along with vitrectomy in 16 of 36 cases.

Conjunctival peritomy was done from 60 to 360 degrees (mean: 179.33 degrees, SD: 124.75).

The average size of unwanted conjunctival lacerations was 2.18 mm. (SD: 4.33, range: 0-25 mm).

Patients were divided into 4 groups according to the instrument used for scleral depression:

In 6 (8%) of the entire cases metal instrument, in 32 (42.7%) cotton applicator, in 14 (18.8%) both and in 23 (30.7%) neither was used.

Patients were divided into 3 groups according to the extent of scleral depression.

In 23 (30.7%) of all cases no scleral depression was applied, in 17 (22.7%) limited and in 35 (46.7%) extended scleral depression was done .

Age and gender did not have any effect on development of dry eye symptoms or abnormal results of tests. Non-diabetics more commonly had abnormal results on tear film tests after the operation.

As can be seen, postoperative dry eye symptoms and abnormal results of tear film tests were more common, in eyes that had larger peritomy size, and inadvertent conjunctival lacerations. These results were also more common in eyes which underwent scleral depression especially in those with extensive scleral depression and those for whom cotton tipped applicator was used for depression (Table 2).

Table 1. Results of pre-operative and postoperative tear film tests

Test	Preop. results (mean±SD)	Postop. results (mean±SD)	
TBUT	16.12 ± 3.69	11.32 ± 3.12	p=0.00, t=0.41
TBST	13.87 ± 4.89	9.24 ± 4.44	p=0.00, t=0.57
Schirmer test	18.66 ± 6.44	13.81 ± 5.64	p=0.00, t=0.77

Table 2. Results of tear film tests and dry eye symptoms according to different factors:

Factor	TBUT	TBST	Schirmer	Dry eye symptoms
Male: Female	p=0.46, t=0.73	p=0.67, t=0.42,	p=0.88, t=0.14,	p=0.75
Age	p=0.43, r=0.09	p=0.2, r=0.14	p=0.39, r=0.9	p=0.95, t=0.06
Diabetics: non-diabetics	p=0.00, t=3.14	p=0.02, t=2.32,	p=0.00, t=3.00	p=0.74
Extent of peritomy (in degrees)	p=0.00, r=-0.38	p=0.00, r=-0.30	p=0.00, r=-0.30	p>0.05
Extent of unwanted conjunctival laceration (in degrees)	p=0.00, r=0.31	p=0.02, r=0.26	p=0.01, r=-0.27	p=0.00, t=3.84
Extent of scleral depression (non, limited, extended)	p=0.00, f=20.29	p=0.00, $\chi^2=15.71$,	p=0.00, f=11.34	p=0.00
Instrument used for scleral depression (none, metallic, cotton applicator, both)	p=0.00, f=11	p=0.00, $\chi^2=28.83$,	p=0.00, f=10.13	p=0.00

Discussion

Development of dry eye has been observed in relation to environmental factors such as cigarettes, exposure to chemicals and industrial materials, some drugs and ocular surgeries such as LASIK.^{1,3,4,14,15}

Tear film disorders following radiotherapy of the orbit for treatment of tumors have also been reported.¹⁰⁻¹³

Although it has been known that vitreoretinal surgeries induce conjunctival changes, there is a paucity of reports regarding prevalence and severity of dry eye after these surgeries.

Heinrich et al¹⁴ reported the conjunctival histopathology in cases with previous vitreoretinal surgery and plaque radiotherapy and compared them with a normal group. They found fibrosis in the conjunctival stroma and reduction of goblet cells in eyes with previous vitreoretinal surgery or radiotherapy. We opted a 3 months interval after the operation for re-evaluation of the tear film, because at this time routine postoperative drops are discontinued and this interval seems enough for resorption of tissue injury and inflammation of the operation. So it seems that the tear film test results would be more real at this time.

Although prevalence of dry eye increases by age and is more frequent in females,¹⁵ development of postvitrectomy dry eye is not dependent on age and gender.

There was less postvitrectomy dry eye in our diabetic patients. This results from: 1- exclusion of eyes with dry eye before surgery. 2- The different type of operation in diabetics and non-diabetics ie: vitrectomy surgery for complications of PDR does not need vitreous base trimming. So both the peritomy size will be less and there will be no or minimal scleral depression. Both of these two factors were found to be important for development of dry eye.

Thirteen eyes (17.3%) developed postvitrectomy dry eye all of which had undergone extended scleral depression, while in none of the patients with local or no scleral depression, dry eye was observed. Of the total of 35 eyes undergoing extended scleral

depression, nearly one third developed dry eye.

Use of cotton tipped applicator for scleral depression caused more post-operative dry eye than metallic instrument. There were also more dry eyes after depression with both instruments. These latter cases were generally the cases which needed extended scleral depression.

We suppose that the cotton tipped applicator produces more dry eye by removal of superficial conjunctival cells. Exposure of the deeper cellular layers which contain the goblet cells makes them more prone to micro-injuries during surgery.

In this study mean of tear film tests in metal instrument was more than cotton applicator. But the incidence of dry eye with metal depressor and cotton applicator were 33.33% and 12.50%, respectively.

After omitting confounding factors (extended depression) from metal instrument, incidence of dry eye decreased to zero and difference of mean tear film test between two groups increased.

The more extended peritomy and unwanted conjunctival rupture, increases the chance of developing dry eye.

Conclusion

Results of this study are consistent with the previous study, confirming the morphologic changes in conjunctiva and decrease of goblet cells after vitreous and retinal surgery and plaque radiotherapy; so we could take these measures during vitrectomy:

- Using the minimum extent of peritomy,
- Avoiding unwanted conjunctival rupture,
- Extended scleral depression only when necessary and affecting prognosis,
- And applying metal instruments for depression

Suggestions:

1. Quantification of scleral depression for further evaluation
2. Longer follow up of patients
3. Evaluation of patients with dry eye symptoms before op.

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