The Effects of Superior Temporal Small Corneal Incisions on Tear Level

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Citation

Abstract
In this study, we aimed to compare tear levels before and after phacoemulsification surgery, and to analyse whether phacoemulsification surgery causes dry eye syndrome or not. 30 eyes were included in this prospective study. Phacoemulsification surgery was applied to the patients. The operation was applied to both eyes of 12 patients. Preoperative, postoperative 1st day, postoperative 1st week and postoperative 1st month examinations of the patients were performed. Symptom scoring (OSDI-Ocular Surface Disease Index), slit-lamp biomicroscopic examinations, Schirmer test and tear breakup time (BUT) examinations were made. We determined the first postoperative day as the most significant day statistically for symptom scoring (p<0.05). The mean of Schirmer test was 7±6.82 in the preoperative period, 14.33±9.41 in the first postoperative day, 9.96±7.79 in the first postoperative week and 7.26±6.66 in the first postoperative month. The highest mean was obtained in the first postoperative day (p=6.47E-09). The mean of BUT test was 4.96±2.08 in the preoperative period, 5.41±1.87 in the first postoperative day, 4.87±1.53 in the first postoperative week and 5.00±1.94 in the first postoperative month. The highest mean was obtained in the first postoperative day (p=2.29-06). We see that means of OSDI scoring, Schirmer test and BUT test hit the top in the first postoperative day. Consequently, we think that superior temporal small incisions to be applied in the phacoemulsification surgeries will not have a negative effect on tear level. But further studies with higher number of patients followed for longer are needed.

1. Introduction

Today, cataract surgery has become one of the surgeries which is most common and performed securely in the most of the patients [1]. Cataract surgery is known to have been performed since ancient times. With the use of intraocular lens and phacoemulsification method, it has made a significant progress recently [2]. In the treatment of cataract, phacoemulsification has obtained an ever-mounting usage area because of earlier refractive stabilization, low astigmatism and milder postoperative inflammation [3].

Dry eye syndrome is one of the most common ophthalmic disorders [4]. Dry eye syndrome is a case which is characterized with the dryness of cornea and conjunctiva which occurs because of tear deficiency and excessive vaporization of tear [5, 6]. Dry eye is one of the most important factors affecting the life quality in old people [7]. This disease is related to the ocular symptoms such as red eye, sensitivity to foreign
body, and fatigue. At the same time, the disease even can lead to cornea keratinization, decrease in the visual acuity, and blindness [8].

Ocular surface diseases and surgical procedures can have a serious effect on the corneal sensitivity by breaking corneal innervation [9]. This situation can lead to breakdown of the epithelial recovery, increase of the epithelial permeability and decrease of the epithelial metabolic activity [10]. In the wearers of contact lens, ocular dryness has been reported at the rates up to 70-80% [11]. The most common complication of the laser-assisted in situ keratomileusis (LASIK) is dry eye [12]. Cataract surgery and some drops can also cause dry eye [13]. After successful cataract surgeries, dry eye symptoms often occur and continue until an effective treatment is applied [8]. It has been reported that favourable outcomes are obtained less in the patients with dry eye after cataract surgeries applied. It has been stated that the patients with conjunctive tissue disease also tend to develop dry eye after cataract surgery [13].

In a study analysing the characteristics of tear, it has been indicated that the patients whose tear break up time before and after phacoemulsification is lower than 10 seconds are significantly under risk for postoperative tear film stability [14]. Moreover, it has been indicated that there is a slight decrease in Schirmer test values and tear break up time after phacoemulsification [15].

In this study, we aimed to compare tear levels before and after phacoemulsification surgery, and to analyse whether superior temporal small corneal incisions cause the occurrence of dry eye syndrome or not.

2. Materials and Methods

30 eyes were included in this prospective study. Phacoemulsification surgery was applied to the patients. The operation was applied to both eyes of 12 patients. The operations were performed in Private Inci Eye Hospital. Informed consent form was taken from all patients. The study was shaped based on the principles of Helsinki Declaration.

The patients who did not use drop before were included in the study. Phacoemulsification and intraocular lens implantation were applied to all patients by one surgeon. Before cataract surgery, drop of 0.5% moxifloxacin (Vigamox; Alcon, Turkey) was dropped in one drop four times a day for three days. By dropping 2.5% phenylephrine hydrochloride (Mydfrin; Alcon, Turkey) and tropicamide (Tropamid; Bilim Turkey) drops three times at intervals of half hour, pupil dilatation was provided. With proparacaine hydrochloride (Alcaine; Alcon), topical anaesthesia was achieved. During phacoemulsification surgery, 2 corneal incisions were applied. One of them was for superior temporal corneal tunnel incision of 2.8 mm. The other was an incision of 1 mm prepared for side puncture in a distance of approximately 60° from corneal tunnel incision. Corneal incisions were not sutured and they were waited for healing spontaneously. Whitestar Signature (Abbott; AMO, USA) device was used for cataract surgeries. Drops were started one day after the cataract surgery. 0.5%-moxifloxacin (Vigamox; Alcon, Turkey) was used in one drop five times a day and 1%-prednisolone acetate (Predforte; Allergan, Turkey) was used in the same way. 0.5%-moxifloxacin was used in one drop five times a day for two weeks, 1%-prednisolone acetate was used in that way in the first 15 days, and they were used in one drop twice in the following seven days and in one drop once in the next seven days.

Preoperative, postoperative 1st day, postoperative 1st week and postoperative 1st month examinations of the patients were performed. Symptom scoring, slit-lamp biomicroscopic examinations, Schirmer test (ST) and tear breakup time (BUT) examinations were made.

For symptom scoring, we used the score that we prepared by modifying Ocular Surface Disease Index score. Based on this scoring, problems that the patients felt were graded with the numbers from 0 to 4. The test was divided into four groups. Light-sensitivity, stinging in the way of feeling gritty in eyes, irritation while reading, and irritation in windy conditions were respectively examined in the first, second, third and fourth group.

The tear breakup time (BUT) tests were performed in a dimly lit room. Fluorescein solution was dropped in the inferior conjunctival sac. The patient was asked to blink and after that moment not to blink anymore. The interval between the moment that the patient firstly blinked and the moment that the first defect occurred in the tear film layer stained with fluorescein was determined as BUT. For Schirmer test, the patient was seated in a chair in a slightly dim room. Wetness in the eyelids of the patient was dried. Schirmer’s paper was folded from the marked point. We asked the patients to look-up and pull the lower lid gently down-ward temporally. We used sterile technique to get Schirmer’s paper from the cover and bend the end of the sterile strip at 5mm mark. It was kept in lateral 1/3 of the lower lid margin and should not be touching the cornea. The patient should continue looking up during the entire test. We noted the time. After 5 minutes, we removed the strip from the eye and measured the length of the moistened area using the millimeter scale on the strip. If the strip became wet completely before 5 minutes we removed prematurely.

Statistical analysis

Comparison of multiple related samples were calculated by Friedman ANOVA test. Statplus Pro 5.9 (Analysoft, USA) software was used for statistical analysis.

3. Results

13 of the patients included in the study (43.3%) were female and 17 of them (56.6%) were male. The mean age was 66.8. After cataract surgery, a lot of patients complained about dry eye symptoms such as stinging, foreign-body sensitivity, fatigue and rubescence. In Table 1, modified OSDI results were given. The symptom score for light-sensitivity was preoperatively 1.2±0.80, 1 day after operation
2.3 ±0.87, 1 week after operation 1.73±0.86 and 1 month after operation 1.73 ±0.85. Postoperative 1st day was statistically the most significant day for light-sensitivity scoring (p=7.46E-07). The symptom score for feeling gritty and stinging was preoperatively 1.03±0.80, 1 day after operation 2.3 ±0.79, 1 week after operation 1.6±0.89 and 1 month after operation 1.23±0.81. Postoperative 1st day was statistically the most significant day for the scoring of feeling gritty and stinging (p=4.07E-07). The symptom score for irritation while reading was preoperatively 1.4±0.81, 1 day after operation 2.43 ±0.77, 1 week after operation 1.56±0.86 and 1 month after operation 1.26±0.82. Postoperative 1st day was statistically the most significant day for the scoring of irritation while reading (p=6.10E-07). The symptom score for irritations in windy conditions was preoperatively 1.5±1.00, 1 day after operation 2.63±0.88, 1 week after operation 1.53±0.86 and 1 month after operation 1.26±0.82. Postoperative 1st day was statistically the most significant day for the scoring of irritation in windy conditions (p=1.21E-08).

In Table 2, means of Schirmer test and BUT test were given. The mean of Schirmer test was 7±6.82 in the preoperative period, 14.33±9.41 in the first postoperative day, 9.96±7.79 in the first postoperative week and 7.26±6.66 in the first postoperative month. The highest mean was obtained in the first postoperative day (p=6.47E-09). The mean of BUT test was 4.96±2.08 in the preoperative period, 5.41±1.87 in the first postoperative day, 4.87±1.53 in the first postoperative week and 5.00±1.94 in the first postoperative month. The highest mean was obtained in the first postoperative day (p=2.29E-06). We see that means of OSDI scoring, Schirmer test and BUT test hit the top in the first postoperative day.

### 4. Discussion

Feeling of dry eye often occurs after cataract surgery. Red and watery eyes can occur and feeling of foreign-body exist in the patients affected. Lesions such as epithelial defects and superficial punctate keratitis on cornea surface can occur [16].

In general, dry eye aetiology occurring after cataract surgery is characterized with one of two mechanisms [17]. In the patients of the first group, dry eye symptoms which existed before have increased. In the patients of the second group, dry eye induced surgically exists. There are several factors that can affect the ocular surface after cataract surgery. Since topical anaesthesia and eye drops includes preservatives such as benzalkonium chloride, they have well-known effects on the corneal epithelium. Exposure to the light of operating microscope can also be related to dry eye [17, 18]. Many corneal surgical procedures can lead to pathological changes of cornea by breaking normal organization of the corneal innervation [19].

Vigorous irrigation of the cornea intraoperatively and ocular surface manipulation deteriorate tear film stability and may reduce goblet cell density and thus cause shortened BUT postoperatively [20]. Several researches have been conducted related to the pathogenesis of dry eye occurring after cataract surgery. It has been considered that the decrease in corneal sensitivity occurring after ocular surface surgery is based on the size of corneal incision [21]. It has been stated that decrease in corneal sensitivity is less after micro-incision surgeries such as phacoemulsification in comparison with refractive surgeries and extracapsular cataract surgery [22]. Li et al. [7] have stated that the most important reason of dry eye occurring after cataract surgery is the misuse of eye droppers. Kohlhaas [23] et al. and Khanal et al. [13] have indicated that there is a significant decrease in central corneal sensitivity after cataract surgery and this decrease causes a decrease in tear production. Ram et al. have stated that small-incision clear corneal cataract extraction causes a slight decrease in Schirmer test and BUT of tear [16]. Oh et al.
have observed that there are significant changes in terms of corneal sensitivity between cornea center and incision site just after cataract surgery. Corneal sensitivity has not returned to normal but a tendency to recover has been observed after one month [8]. Decreases in corneal sensitivity after ocular surface surgery have been considered to be related to the length of corneal incision. It is expected that micro incisional surgeries such as phacoemulsification cause less decrease in corneal sensitivity in comparison with refractive surgeries and extracapsular cataract surgeries [22]. Oh et al. have determined a decrease in corneal sensitivity in the first postoperative day despite of minimal corneal involvement but they have observed that it has returned to normal levels in the first and third month after surgery. In another study, it has been observed no return to the levels in corneal sensitivity in the preoperative period until the period 3 month after surgery. This difference can be related to the size of corneal incision applied during cataract surgery. Therefore, it has been proposed that increase of the incision size can cause recovery in corneal sensitivity to slow down [8].

Many surgical procedures can lead to denervation of cornea, which causes breakdown of epithelial wound recovery, increased epithelial permeability, decreased epithelial metabolic activity and loss of cytoskeletal structure associated with cellular adhesion. Corneal sensation is the function of long ciliary nerves of ophthalmic division of fifth cranial nerve (trigeminal). Large nerves of long ciliary nerve trunk mostly penetrate into limbus in the position of 9-o’clock and 3-o’clock, which explains why corneal sensation is significantly more in temporal and nasal limbus. Even though the physiological role of the corneal innervation on cornea has not been understood clearly, it has been proposed that this neuroregulation is responsible for maintaining of the integrity and repair of corneal epithelium. Moreover, intact corneal sensation is responsible for a part of tear production. Decrease in corneal sensation causes a decrease in tear production [16, 24].

The results of our study have indicated that there is significantly change in symptom scores, corneal sensitivity and tear level in the first postoperative day. After that, recoveries have been observed. The values have gotten close to preoperative level in the end of the first month. The results of Schirmer test and BUT test has hit the top in the first postoperative day. We think that the reason for that is irritation occurring because of epithelial defects in incisions. Unlike most of the other studies, we have observed that there is no significant difference between preoperative period and postoperative period results of the tests we have conducted related to tear. We have concluded that superior temporal incision of 2.8 mm that we have applied in phacoemulsification surgeries is the reason for that.

As a conclusion, because of large nerves of long ciliary nerve trunk mostly penetrate into limbus in the position of 9-o’clock and 3-o’clock, superior temporal small incisions to be applied in phacoemulsification surgeries will not have a negative effect on large nerves of long ciliary nerve trunk and on tear level. But further studies with higher number of patients followed for longer period are needed.

References


