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Original Article

WATERING OF THE EYES FOLLOWING UNEVENTFUL PHACOEMULSIFICATION CATARACT SURGERY

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Abstract

Background: *Epiphora is a common presentation to the general ophthalmologist. Causes of epiphora may be caused by secretory problems or problems with the excretory side of the lacrimal system. Epiphora due to postoperative punctual and/or canalicular stenosis or obstruction may follow uncomplicated phacoemulsification surgery.* ***Objectives:*** *The aims of the current study were to assess the incidence of the post phacoemulsification watery eye and to assess the possible causes of the post phacoemulsification watery eye.* ***Methods:*** *a cross sectional study that was carried out at ophthalmology department, Faculty of medicine, Sohag University hospitals from 1st November 2022 to 28th February 2023 among randomly selected fifty patients who had undergone uncomplicated phacoemulsification.* ***Results:*** *Our study showed that 56% of patients hadn't watering of eyes while 44% of patients complained of watering of eye three months post phacoemulsification in form of 32% of patients had dry eye disease 10% of patients had punctual obstruction and 2 % of patients had mixed dry eye disease and punctual obstruction. Assessment of special tests for dry eye and outer punctual diameter (OPD) revealed that there was statistically significant difference between eyes without watering and eyes with watering regarding dye disappearance test, Schirmer's 1 test, Schirmer's 2 test, tear break up time (TBUT) and OPD.* ***Conclusion:*** *In conclusion, watering of eye is inevitable after cataract surgery. All the dry eye test values showed deterioration following surgery. We observed that cataract surgery is capable of aggravating dry eye and affecting dry eye test values.*

Keywords: *Health promoting behaviors, Health promoting lifestyle, Health promoting lifestyle profile, university student*.

1. Introduction

Epiphora refers to the excessive flow of tears over the face, which occurs outside of the regular act of crying. Epiphora is a clinical manifestation or state characterized by inadequate drainage of the tear film from the eyes, resulting in tears flowing down the face instead of passing via the nasolacrimal system [1]. Epiphora can be caused by either excessive tear production or reduced tear drainage, leading to tears flowing across the cheek [2]. Phacoemulsification is a contemporary surgical technique used to remove cataracts. It involves breaking apart the

eye's internal lens using high-frequency sound waves and then removing it by suction. To maintain the anterior chamber, aspirated fluids are substituted with irrigation of balanced salt solution (BSS) [3]. Phacoemulsification is now the preferred technique for cataract surgery, despite indications of a greater incidence of problems compared to extra capsular cataract extraction (ECCE) or intra capsular cataract extraction (ICCE) procedures [4]. Historically, residents have been instructed to first master ECCE before acquiring the phacoemulsification technique for cataract removal. This is partly because ECCE is considered to be less demanding and associated with less reported problems [5]. The increased occurrence of complication rates in phacoemulsification may be attributed to the "learning curve" associated with handling instruments within the eye, rather than being a result of the method itself [6]. Although cataract procedures are crucial for enhancing vision, A considerable proportion of patients continue to experience dissatisfaction due to the presence of postoperative dry eye symptoms. Postoperative corneal hypoesthesia is a common occurrence following ECCE surgery, resulting from the extensive incision that reduces corneal sensitivity and may potentially cause corneal injury. This condition can also manifest in cases of phacoemulsification [7]. Some individuals had tearing after undergoing phacoemulsification surgery for senile cataract. Secondary acquired lacrimal drainage blockage is believed to occur as a result of various factors [8]. Lacrimal drainage dysfunction may occur during phacoemulsification surgery in eyes with agerelated cataracts. Two potential mechanisms might be postulated to explain the findings of this study: First mechanism is inflammation of the surface of the eye and the anterior segment of the eye that has undergone surgery may spread to the lacrimal system and result in reduced function. The amount of ocular inflammation can be influenced by surgical trauma, subconjunctival injections, and the preparation of eyelids and conjunctiva with povidone solution prior to surgery. This is due to the potential leakage of povidone solution into the drainage system [9]. Second mechanism is reduced intensity of blinking by the patient during the initial period after surgery may result in a weakened lacrimal pump, which could mimic a functional blockage in an already damaged lacrimal system due to aging [10]. The current study aimed to assess the incidence of the post phacoemulsification watery eye and to assess the possible causes of the post phacoemulsification watery eye.

2. Methods

A cross sectional study was conducted at Ophthalmology department, Faculty of medicine, Sohag University hospitals among fifty eyes of randomly selected 50 patients with cataract who prepared for phacoemulsification (From 1st November 2022 to 28th February 2023) after fulfilling the eligibility criteria, inclusion criteria: Patients with age-related cataract and exclusion criteria: Patients with watering of eyes or ocular surface diseases or watering of the eyes, patients with previous ocular surgeries and patients with glaucoma, uveitis, corneal or retinal pathologies. The surgeries were performed by multiple surgeons. Data was collected from patients through detailed history taking, full ophthalmological examination, fluorescein dye disappearance test which was done by administering drops of fluorescein solution, often at concentrations of 1% or 2%, into the conjunctival fornices of both eyes and the presence of prolonged retention suggests insufficient

lacrimal drainage, Schirmer's test that was done by excess tears or topical anesthetic are gently dried, then the filter paper is folded at a distance of 5 mm from one end and carefully placed at the point where the middle and outer third of the lower eyelid meet and the patient is directed to softly close their eyes. After duration of 5 minutes, the filter paper is extracted and the extent of wetting from the fold is quantified and finally wetness of less than 10 mm within a 5-minute in schirmer 1, or wetting of less than 6 mm in schirmer 2 is abnormal. Regatding TBUT test, fluorescein 2% or a fluorescein strip that has been impregnated and moistened with non-preserved saline is performed by placing it into the lower fornix. The patient is instructed to perform multiple blinking movements and the examination of the tear film is conducted using a broad beam and the cobalt blue filter at the slit lamp, the fluorescein-stained film exhibits black spots or lines. Tear break up time refers to the duration between the last blink and the appearance of the first randomly distributed dry spot and BUT of less than 10 seconds is suspicious. Measurement of outer punctual diameter (OPD) by Topcon 3D Spectral Domain AS-OCT-2000 series, All OCT images were obtained by one operator on a separate day without any further manipulation for ophthalmic examination. The lower lid punctum was exposed by gently everting the medial part of the eyelid without pressure or stretching, thus bringing the vertical canaliculus into the axial plane. A crossline scan (2 mm × 2 mm) was centered on the studied punctum for alignment; then a cross-scan was obtained. Three scans were obtained for each examined eye. The operator then chose the images with the clearest, widest, and deepest measurable diameters. For all the studied subjects, the overall punctual shape and contents were evaluated then the outer, that is, towards the lid margin, diameter was measured using the adjustable distance measurement tool. Preoperative procedures were done through a clear corneal incision with a 2.8 to 3.2 mm keratome along with two paracenteses. Then after staining the anterior lens capsule, capsulorhexis of the desired size is performed, and the nucleus is emulsified and aspirated through an ultrasonic phaco probe inserted through the main wound. Following this, the remaining cortical matter is removed from the capsular bag, and a foldable IOL is implanted. The surgery is performed under topical or local anesthesia or as an elective procedure and the patient discharged at the same day. Post-operative medications were prescribed that included: drugs in form of Moxifloxacin eye drops, topical corticosteroid eye drops, combination ointment of tobramycin and dexamethasone. The eye drops were given each hour in 1st two days post-operative, five time per day for the next five days, three time per day for 2nd week, twice daily for 3rd week, once daily for 4th week while ointment was given once daily for 1st week. Follow-up regimen was done through dye disappearance test, Schirmer's test, Tear break up time test, Anterior segment OCT. Statistical analysis: Statistical package of social science (SPSS) version 25.0 was used for data entry and analysis. Quantitative variables were expressed as means and standard deviation for normally distributed data and as median and range (minimum – maximum) for not normally distributed data. The normality of data distribution was tested using Kolmogrov-Sminrov test. Qualitative variables were described as frequencies (percentages). Ethical considerations: Approval of the Ethical committee of faculty of Medicine, Sohag University was obtained and informed written consent was taken from all patients.

3. Results

Table (1) shows the mean age of the participants was (60.52 ± 7.25) with a range of (50- 75) years. More than half of the participants were older than sixty years (56%). About two thirds of them were females (58%). The mean of time of phacoemulsification in minutes was (4.85 ± 1.87). Moreover, the mean of cumulative dissipated energy (CDE) was (15.5 ± 11.8). The comparison between special dry eye tests and Outer punctal diameter (OPD) assessment preoperative and post-operative was shown in tab. (2). There was highly statistically significant difference between the mean of dye disappearance test pre-operative and three months post-operative (P-value <0. 05). The mean of dye disappearance test three months post-operative was more than that of pre-operative (3.18 ± 0.78 and 2.84 ± 0.62) respectively. There was highly statistically significant difference between the mean of Schirmer's 1 test pre-operative and three months post-operative (P-value <0.05). The mean of Schrimer's 1 test post-operative was lower than that of pre-operative (11.4 ± 3.54 and 14 ± 2.65) mm respectively. In addition to comparison of schirmer's 2 test, the mean of Schrimer's 2 test three months post-operative was lower than that of pre-operative (6.72 ± 2.54 and 8. 56 ± 1.9) mm respectively. As regards tear preak up time test (TBUT), there was highly statistically significant difference between the mean of TBUT test pre operative and three months post-operative (P-value <0.05). The mean of TBUT three months post-operative was lower than that of pre-operative (11.62 ± 2.43 and 13.12 ± 1.84) seconds respectively. As regards outer punctual diameter, there was highly statistically significant difference between the mean of outer punctual diameter pre-operative and three months post-operative (P-value <0.05). The mean of outer punctual diameter three months post-operative was lower than that of pre-operative (349.86 ± 118 and 373.82 ± 119.77) µm respectively. As illustrated by tab. (3), More than half of the studied participants had normal eyes three mon-ths pot phacoemulsification (56%). About one third of the studied participants complained of dry eyes three months post-operative (32%). On the other hand, 10% of the studied participants were diagnosed with punctual obstruction three months post-operative (10%) while only 2% of the studied participants were diagnosed with dry eye and punctual obstruction at the same time. As illustrated by tab. (4), there was statistically insignificant difference between watering condition of eye according to age groups and gender of the studied patients (P-value >0.05). Regarding intraoperative factors affect outcome of surgery, there was statistically insignificant difference between watering condition of eye according to time of phacoemulsification and cumulative dissipated energy (P-value >0.05).

Table 1: Socio-demographic characteristics and intraoperative factors affect outcomes of surgery intraoperative of the studied participants

Variable		Summary statistics (n = 50)	
		No.	%
Age (years)	***Mean ± S.D***	60.52 ± 7.25	
	Median	60	
	Range (Min – Max)	(50-75)	
Age groups	***≤ 60 y***	22	44
	> 60y	28	56
Gender	***Male***	21	42
	Female	29	58

Time of phacoemulsification (minutes)	***Mean ± S.D***	4.85 ± 1.87
	Median	4.65
	Range (Min-Max)	(2-10)
Cumulative dissipated energy (U/S)	***Mean ± S.D***	15.5 ± 11.8
	Median	12
	Range (Min-Max)	(3.5-62)

Table 2: Comparison between special tests for dry eye and outer punctual diameter preoperative and three months post-operative of the studied participants.

Variable		Pre-operative	Post-operative	P-value*
Dye disappearance test	***Mean ± S.D***	2.84 ± 0.62	3.18 ± 0.78	< 0.0001
	Median	2.83	3	
	Range (Min-max)	(2 – 4)	(2 – 4.83)	
Schirmer's 1 test (mm)	***Mean ± S.D***	14 ± 2.65	11.4 ± 3.54	< 0.0001
	Median	14	12	
	Range (Min-max)	(10 – 22)	(5 – 20)	
Schirmer's 2 test (mm)	***Mean ± S.D***	8.56 ± 1.9	6.72 ± 2.54	< 0.0001
	Median	8	7	
	Range (Min-max)	(6 – 15)	(4 – 15)	
Tear break- up time (sec)	***Mean ± S.D***	13.12 ± 1.84	11.62 ± 2.43	< 0.0001
	Median	12	12	
	Range (Min-max)	(10 - 16)	(6 - 16)	
Outer punctual diameter (µm)	***Mean ± S.D***	373.82 ± 119.77	349.86 ± 118	< 0.0001
	Median	354	334.5	
	Range (Min-max)	(80 – 670)	(80 – 640)	

Table 3: Watering condition of eyes three months post phacoemulsification of the studied participants

Variable		Summary statistics (n = 50)		Total
		No.	*%*	*No.%*
Eyes without watering		28	56	28(56%)
Eyes with watering	***Dry eye***	16	32	22(44%)
	Punctual obstruction	5	10	
	Dry eye & punctual obstruction	1	2	

Table 4: Relation between the watering conditions of eye according to sociodemographic characteristics and intraoperative factors affect outcome of surgery of the studied participants

Variable			Normal eye (n=28)	Abnormal eye (n=22)	P-value
Age	**≤ 60 y**	**No.**	19	10	0.1
		%	65.5	34.5	
	> 60 y	**No.**	9	12	
		%	42.9	57.1	
Gender	**Male**	**No.**	12	9	0.8
		%	57.1	42.9	
	Female	**No.**	16	13	
		%	55.2	44.8	
Time of phaco-emulsification in minutes		**Mean ± S.D**	4.58 ± 1.74	5.2 ± 2.01	0.25
		Median	4	5.41	
		(Min- Max)	(1.83 – 10)	(1.5 – 10)	
Cumulative dissipated energy		**Mean ± S.D**	15.03 ± 10.75	16.1 ± 13.26	0.75
		Median	11.7	13.5	
		(Min- Max)	(3.8 – 50)	(3.5 – 62)	

4. Discussion

Cataract is the leading cause of blindness and cataract surgery is one of the successful and classic surgeries among the ophthalmic surgeries. However, many patients complain of discomfort after surgery despite of good visual outcome. Reason for dry eye symptoms following cataract surgery may be either preexisting dry eye or surgically induced dry eye [11]. Dry eye syndrome is a complex condition affecting the tear film in front of the cornea, causing discomfort, vision problems, and instability of the tear film. It has the potential to harm the surface of the eye [12]. Our study revealed that 32% of the studied participants complained of dry eyes three months postoperative. Our findings were nearly similar to a hospital-based cross-sectional study that was reported by Hamed et al. who showed that the incidence of dry eyes three months after the surgery was 22% [13]. Furthermore, a prospective study was conducted by Dhawan et al. who showed that the incidence of dry eye was 11% which is lower than our results [14]. Our results aren't similar to the results of a prospective observational study was conducted by Ishrat et al. who revealed that the incidence of dry eye among the patients three months after the surgeries was 9% [12]. The difference between the incidence of dry eye after phacoemulsification in our study and other studies can be explained by different factors transection of the corneal nerves and damage to the corneal epithelial cells, exposure to microscopic light, vigorous intra operative irrigation of the tear film, elevation of inflammatory factors in the tear film due to ocular surface irritation, use of topical anesthesia intra-operatively and topical eye drops administered postoperatively and its excessive instillation and incorrect use of preserved eye drops and variability of surgeons' experience. Moreover, a study revealed that benzalkonium chloride, a frequently employed preservative in topical eye drops, can induce tear film instability and diminish the quantity of mucin-producing cells, hence intensifying and leading to symptoms of dry eye. Hence, discontinuing the usage of preservative eye drops or opting for preservative-free topical eye drops can alleviate dry eye symptoms [15]. As illustrated by our study, there was highly statistically significant difference between the mean of Schirmer's 1 test pre-operative and three months post-operative (P-value <0.05). The value of Schrimer's 1 test pre-operative was 14 ± 2.65 mm which decreased to 11.4 ± 3.54 mm three months post-operative and didn't reach the pre-operative value. In addition to comparison of schirmer's 2 test, the value of Schrimer's 2 test pre-operative was 8.56 ± 1.9 mm which decreased to 6.72 ± 2.54 mm three months post-operative and didn't reach the pre operative value. Our findings align with a retrospective clinical cohort study that was conducted by Tawfeek and Hamid who demonstrated similar results to ours. The average preoperative Schirmer's I test values of the subjects under study were 12.36 ± 3.1 mm. After three months postoperative, these values fell to 11.1 ± 1.93 mm. There was a substantial decrease in the score at 3 months after the surgery compared to the score before the surgery [16]. However, the findings of our study weren't in line with the findings of a prospective randomized study that was conducted by Shrivastava et al. who showed that Schirmer's I test result was no discernible difference between the results at 90 days postoperatively and the pre-operative levels [17]. Furthermore, our study was in agreement with a case control study that was conducted by Liu et

al. who revealed that postoperative Schirmer's test levels were statistically significantly lower than preoperative values and after 180 days, readings were gradually brought back to their preoperative levels before being restored to normal [18]. The results of the current study aren't in line with an observational prospective study conducted by Abd- El Moez et al. who showed that no significant differences were found on Schirmer test values between baseline measurements at preoperative and postoperative, 14.1 ± 2.2 mm and 13.8±1.5mm, respectively [19]. Also, our study wasn't in agreement with a prospective, observational, cohort study that was conducted by Gharaei et al. who showed that there was no statistically significant difference between the preoperative and postoperative outcomes of Schirmer's test [20]. As regards tear break-up time test, our findings revealed that there was highly statistically significant difference between the mean of tear break-up time test value pre-operative and three months post-operative. The mean of tear break-up time test value three months pre-operative was 13.12 ± 1.84 seconds which decreased to 11.62 ± 2.43 seconds post-operative. In accordance to studies performed by Tawfeek and Hamid who revealed that the mean TBUT of our patients before surgery was 11.57 ± 2.12 seconds and the score decreased to 10.05 ± 1.98 seconds three months postoperatively, so there was a statistically significant reduction of the score at three months after the surgery as compared with the preoperative value that is in line with our results [16]. Moreover, the findings of the current study are in agreement with a prospective study that was performed by Oh et al. who showed a substantial reduction in TBUT three months post-operative [21]. Our findings aren't in line with study that was conducted by Ishrat et al. who reported that there was nonsignificant difference between value of TBUT three months post-operative in comparable to the value of TBUT preoperative [12]. In agreement with a prospective study was conducted by Cho and Kim who found that after cataract surgery, the severity of dry eye symptoms and the results of diagnostic tests increased compared to the preoperative data [22]. In agreement with a study conducted by Abd-El Moez et al., who showed that there was a notable disparity in the tear BUT test between the measurements taken before and after the operation. The baseline measures preoperatively and postoperatively were 11.1 ± 1sec and 8.8 ± 1.3 sec, respectively [19]. Consistent with our study, GharaeI et al. who conducted a study and revealed that there was a considerable disparity in TBUT levels between preoperative and postoperative examination [24]. Also, our findings as regards TBUT value are in agreement with a prospective observational study that was done by Han et al. who revealed that the value of TBUT preoperative was 6.7 ± 3.0 sec and decreased to 4.1 ± 2.0 three months post-operative and there was statistically significant difference between them [23]. In this study, we found a significant change in the measurement of the outer punctual diameter using AS-OCT. Specifically, we observed a statistically significant decrease in the mean diameter from pre-operative to three months post-operative. The average outer punctual diameter before surgery was 373.82 ± 119.77 μm, which decreased to 349.86 ± 118 μm three months after surgery. Comparable to our results with study that done by Allam and Ahmed who showed that the mean outer diameter of the lower punctum was 412.16 ± 163 μm, which was higher than our post-operative estimates [(24)]. Also, in comparison to a study that was carried

out by Timlin et al. who showed that the mean external punctual opening size was 615μm' (SD 367, range 410 to 872) which is higher than our estimates [25].

5. Conclusion

In conclusion, Dry eye disease is inevitable after cataract surgery. All the dry eye test values showed deterioration following surgery. We observed that cataract surgery is capable of aggravating dry eye and affecting dry eye test values. The results of our study showed that the values of the dye disappearance test, Schirmer's test, TBUT (tear break-up time), and OPD (ocular pulse amplitude) measures, as measured by spectral domain anterior segment optical coherence tomography (AS-OCT), were found to be different after the surgery compared to the data gathered prior to the surgical procedure. Prior to undergoing surgery, it is essential to do a thorough preoperative evaluation of all patients. Additionally, patients should be adequately informed about the potential exacerbation of dry eye symptoms. To mitigate corneal damage and alleviate dry eye symptoms, it is recommended to prescribe artificial tears.

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