

A PROSPECTIVE OBSERVATIONAL STUDY REGARDING PREVALENCE OF DRY EYE DISEASE IN POST-OPERATIVE CATARACT SURGERY PATIENTS OF 140 CASES.

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ABSTRACT

BACKGROUND

Dry eye disease is one of the most common ocular surface disorder with large number of studies carried out in various countries estimate the prevalence of dry eye disease to be between 5-34%. The prevalence of dry eye increases with age. As per Breaver Dam study regarding dry eye the prevalence of DED 13.3%. Dry eye was apparently higher in women than men. Studies have shown that cataract surgery worsen dry eye symptoms in patients with preexisting dry eye symptoms as well as without preexisting DES, mostly dry eye symptoms last for two months of post cataract surgery period.

MATERIALS AND METHODS

The prospective observational study was conducted in Department of Ophthalmology, Government Vellore Medical College and Hospital, Vellore. The total number of cataract surgery performed cases were 140 in number. The study period was four months, conducted in tertiary eye center. The Cataract patients were preoperatively at normal tear secretions. Post cataract surgery period from first POD, one week POD, four weeks, six weeks, two months and three months POD examined by slit lamp, Schirmer's test I, TBUT and corneal sensitivity test were performed.

RESULTS

Our study revealed that increased prevalence in female sex with increased age group range from 51-70 years showed post cataract surgery period dryness of eye. The ratio of Post cataract surgery DED in male and female is 13:29. This shows increased female sex prevalence of postoperative DED. In our study, the prevalence of post cataract surgery dry eye disease was 30%.

CONCLUSION

73% cataract surgeries is now clear corneal cataract surgery and this procedure cuts a large part of corneal nerves. The nerve essential for tear production gets disturbed leading to dryness and hence decreased visual function. The corneal nerves are important in self-regulation of tears since they provide the sensation in the feedback loop that signals tear production. When the functions of the nerves get blocked or decreased, the tear film instability leading to dryness and discomfort and reduced vision to the patients.

KEYWORDS

Post-Operative DED (dry eye disease), cataract, Schirmer's test, corneal sensation, POD (post-operative day), Phacoemulsification.

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BACKGROUND

As per WHO report, approximately 10 million operations are performed each year in the world, with rates varying from 100-6000 operations per million population per year. In India, the cataract surgery rate (CSR) rate has approximately doubled in the last 10 years and is now around 3000. Economically well-developed countries usually

perform 4000-6000 cataract operations per million population per year.

Our study was conducted to assess the DED post-operative period of 140 cataract surgery individuals wherein the preoperative period in them there was no DED. The post-operative follow up period was first post-operative day, one week, four weeks, six weeks, two months and three months after surgery.

After cataract surgery, the corneal sensation gets impaired which last for about one to three months period and reduced tear secretion resulting in DED. The subsequent complications like corneal epithelial integrity alteration impaired epithelial wound healing, epitheliopathy, infected corneal ulcer and perforation resulting in permanent visual loss.

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Mean goblet cells density decreased significantly after Cataract Surgery which correlated with operative time and had recovered at three months after surgery. Microscopic ocular surface damage during cataract surgery seems to be one of the pathogenic factors that cause ocular discomfort and dry eye postoperatively.

Modern phacoemulsification though minimise corneal trauma, even micro incision can have denervation of cornea resulting in impaired epithelial wound healing, increased epithelial permeability and decreased metabolic activity.¹ To maintain corneal epithelial integrity, neuroregulation of cornea is necessary.² Changes in corneal sensation, reflex and tear film stability, as well as alteration in epithelial integrity can be expected after cataract surgery. Surgical plan should be adjusted to minimise such changes in the dry eye patients. Decreased corneal sensation may lead to reduced lacrimal gland tear production, which in turn can lead to dry eye symptoms.²

Khanal et al. demonstrated a decreased corneal sensitivity and tear production after cataract surgery.³

Oh et al. measured a significant reduction in central corneal and incision site sensitivity after cataract surgery, which will resolve after one month.⁴

Cho et al, investigated corneal incision location on dry eye symptoms. He found that even main wound is placed at 3 or 9 o'clock position where long ciliary nerve enter limbus, severe dry eye symptoms develop after grooved incision compared to single plane incision to eye.⁵ Patient without preoperative dry eye had significantly aggravation of dry eye symptoms, reduced tear breakup time and impaired aqueous tear production after phacoemulsification.⁵ One of the major risk factors for developing DES or exacerbation of preexisting DES is an ocular procedure most commonly cataract or LASIK surgery.

AIMS AND OBJECTIVES

The study conducted was cohort study .The total number of cases were 140. The study period was four months in 2016 in tertiary eye center. The patients were directly admitted from eye OPD as well as referred by ophthalmic assistants from villages through eye camp. All the patients were subjected to routine ophthalmological examination for cataract surgery apart from routine screening for diabetes mellitus and hypertension. The preoperative period symptomatic DED cases were excluded from our study. The visual acuity by Snellen chart, cycloplegic refraction, intraocular pressure by applanation or Schiottz tonometer, duct patency by syringing test, fundus examination by direct and indirect ophthalmoscope, IOL power calculation after keratometry and A scan, tear break up time, slitlamp

examination, pre and post operative period Schirmer's test and corneal sensitivity test were performed in all cases.

MATERIALS AND METHODS

Inclusion Criteria

Both male and female of age group between 30 and 85 years age group, absence of DED preoperative period, both mature and immature cataract cases were included in our study. Associated hypertension and diabetes mellitus patients were also included in our study.

Exclusion Criteria

Pre-operative period of dry eye diseases, HIV positive individual, anterior segment abnormalities like pterygium, corneal oedema, other causes of dry eye like rheumatoid arthritis, drug intake history like beta blockers, antihistamine, tricyclic antidepressant, diuretics, meibomian gland dysfunction (MGD) present in preoperative periods were excluded from our study

RESULTS

In our study, out of 140 cases the ratio of cataract as per sex distribution in male and female is 48:92. The ratio of cataract operated patients based on laterality in right and left eye is 59:81. The various age group studied were between 30-90 years. Among these the increased prevalence was between 51-60 years 47 cases and between 61-70 years 61 cases. The majority of patients fall among 51-70 years age group period itself (77.14%). The increased sex prevalence in female as 92 cases compared to male as 48 cases were noticed. Out of 140 cases mature cataract operated in 49 cases and immature cataract in 91 cases.

Out of 48 male patients, 35 patients with 1st post-operative period showed more than 10 mm Schirmer's test I reading, 4 patients with 5-10 mm reading and 9 patients presented with less than 5 mm reading. Similarly, out of 92 female patients Schirmer's test I more than 10 mm in 63 patients, 5-10 mm in 27 cases and less than 5 mm in two cases were present. Totally 42 patients were suffering from abnormal Schirmer's test I values. TBUT less than 10 seconds in 30% of cases was also observed. Rest of 98 cases were normal without DED clinical evidence. The post-operative DED was present in increased prevalence in female compared to male as male:female=30.95%:69.05% out of 42 cases. 70% of individuals were not suffering from postoperative DED among the 140 cases operated.

Analysis Cases of Total Studied (140) With Reference to Various Factors

Sex Distribution		Laterality		Mature Cataract	Immature Cataract
Male	Female	RE	LE		
48	92	59	81	49	91
34.29%	65.71%	42.14%	57.86%	35.0%	65.0%

Status of other Eye

Pseudophakia	Immature Cataract	Mature Cataract	Clear Lens	Pre-operative DED Whether Present in other Eye
45 (32.14%)	72 (51.43%)	7 (5.0%)	16 (11.43%)	No

Age Distribution With Respect to Total Number of Cases in Our Study

Age in Years	Number of Cases
30-40	2
41-50	13
51-60	47
61-70	61
71-80	13
81-90	4

In our study increased prevalence between 51-70yrs age group is 77.14%.

Symptoms and Clinical Signs in 42 DED Cases

Symptoms	Number of Cases
Irritation	42
Burning	42
Redness	42
Foreign body sensation	12
Visual fluctuation	12

Signs	Number of Cases Presented
Punctate Epithelial Erosions	12
Filamentary Keratitis	05
Bacterial Keratitis	Nil
Corneal Perforation	Nil
Superficial Corneal Vascularisation	02
TBUT (less than 10 sec)	42
Thin Tear Meniscus (Less than 1 mm in Height)	42

Post Operative Period Schirmer’s Test I Values

	>10 mm		5-10 mm		<5 mm	
	Male	Female	Male	Female	Male	Female
1 ST POD	35	63	4	27	9	2
1 Week POD			4	27	9	2
4 Weeks POD			3	16	6	2
6 Weeks POD			2	10	-	-
2 Months POD			-	5	-	-
3 Months POD			-	-	-	-

Mode of Cataract Surgery in 140 Cases of our Study

SICS with PC IOL	PHACO with Foldable IOL
131	7

Factors Influencing DED in Post Cataract Period

1. Mode of surgery and type of incision – Grooved incision, Temporal incision, Large limbal cataract incision leads to injury to more corneal nerves and impaired corneal sensation and DED.

2. Type of IOL implantation– Accommodative IOL. /Multifocal IOL
3. Post-operative impaired tear production.
4. Toxic epitheliopathy following preservative added lubricant corticosteroid and antibiotic eye drops leading to tear filled instability and DED.
5. Ocular surface inflammation, tear hyper osmolarity, reflux tear evaporation, impaired corneal sensation, reduced blink rate, decreased goblet cells density – lead to post cataract surgery DED.
6. Increased age group.
7. Female sex prevalence usually combined with multi factor causes (post-menopausal hormonal influence).
8. Associated diabetes mellitus for more than 20 yrs duration with PDR, polyneuropathy with chronic kidney disease lead to DED.
9. Preexisting DED will aggravate DED in post cataract surgery period.

Post Cataract Surgery DED vs Non DED Cases

Post Cataract Surgery			
NO DED cases	Percentage	DED cases	Percentage
98	70%	42	30%

Grading of DED (Post-Operative) in Our Study

Mild to Moderate DED (Out of total 140 Case Study)				Severe DED Cases (Out of total 140 Case Study)			
Male	%	Female	%	Male	%	Female	%
4	9.5%	27	64.29%	9	21.42%	2	4.76%

Post-Operative DED Recovery Status

Duration of Recovery	Cases Recovered from DED
6 weeks	30
6 weeks to 2 months	7
2 months to 3 months	5

operative period dry eye with delayed recovery especially in females were noticed probably due to increased age with post-menopausal group individuals, associated disease like diabetes mellitus with prolonged duration of diabetes along with impaired corneal sensitivity, polyneuropathy and severe nonproliferative or proliferative diabetic retinopathy changes.

Post-Operative Visual Status

No. of Cases	Preoperative Vision	Post-operative Vision	No. of Cases
49 (Mature Cataract)	HM –PL+	6/18	30
		6/12	07
		6/24	09
		6/60	03
91 (Immature Cataract)			
02	1/60-2/60	6/60	02
54	3/60-6/60	6/18 6/12	34 20
35	6/36-6/24	6/18 6/12	24 11

Sex Wise DED Prevalence in Our Study

DED Prevalence in our Study	Male DED	Female DED
30%	9.29%	20.71%

In our study, 5 patients regained corneal sensation and recovered from dry eye between 2-3 months post operatively. This delayed recovery was noticed in diabetic of more than 20 yrs. duration with more than 60 yrs. age group associated with polyneuropathy features.

Among 29 diabetic patients in our study, 18 cases were suffering from impaired corneal sensation. Over the follow up period, 13 cases regained corneal sensation and also impaired Schirmer’s test to regain normal level over a period of two months. Delayed recovery from impaired corneal sensation in diabetic patients after cataract surgery was due to more than 20 years duration of diabetes of 55-75 age group. The associated hypertension was present in 22 individuals and both hypertension and diabetes were in eight individuals. Out of 140 cases, 131 cases were operated for cataract by small incision cataract surgery with posterior chamber intra ocular lens implantation and 7 cases were managed by phacoemulsification with foldable intraocular lens implantation.

Out of 42 cases of postoperative dry eye cases, 27 female and 4 male were suffering from moderate dry eye and 9 male and 2 female were affected by severe dry eye in post cataract surgery period. 37 individuals regained tear film stability over 2 months post-operative period itself. Remaining 5 cases took two months to three months duration to recover from dry eye state. The variation in post-

DISCUSSION

The increased prevalence of post-cataract surgery dry eye syndrome depends upon various factors like increased age, female sex, increased tear osmolarity, decreased corneal sensitivity, reduced tear production, preservative added antibiotic and steroid eye drops, corneal incision cutting the majority of corneal nerves, associated disease in cataract like Diabetes Mellitus of long duration with polyneuropathy and proliferative diabetic retinopathy changes, duration of surgery, mode of surgery, the type of incision as well as the effect of paired limbal relaxing incisions employed in premium IOL cataract surgery.

Dry eye syndrome is a complex disease that present symptoms including ocular discomfort, tear film instability, and visual changes. It affects the routine reading, driving and affects patient's quality of life. Between 5% and 34% of the population suffer from DES prevalence.

Dry eye is a common cataract surgery complication that can affect patients comfort and visual outcome and result in permanent damage to the ocular surface.⁶

The prevalence increases with age.⁷

The significant increase in tear osmolarity after cataract surgery remained increased level upto 4-5 weeks in the postoperative period. The value increased from 309.6 mmoles to 318.9 mmoles in the post cataract surgery period.⁸ Li et al. Showed that incidence of dry eye syndromes after cataract surgery, with simultaneous development of squamous metaplasia in bulbar conjunctival epithelium.^{7,9}

One of the major risk factors for developing DES or exacerbating preexisting DES is an ocular procedure commonly cataract or LASIK surgery.

The effect of paired limbal relaxing incisions on corneal sensation as measured with cochet-bonnet aesthesiometer and found that 39% of patients had a reduction in corneal sensation which persisted for over three months. This limbal relaxing incisions are frequently employed in premium IOL cases, in which the patients' expectations are high.⁹ The cataract surgery has effect on tear osmolarity which gets increased in postoperative period and remain elevated for upto 5 weeks after surgery. The Prospective Health Assessment of Cataract Patient Ocular surface (PHACO) study was a multicenter prospective study in cataract surgery patient with dry eye which showed 49% of eyes had a score of less than 10 mm on Schirmer's testing.¹⁰

TBUT of less than 10 seconds is indicative of DED.¹¹ although a TBUT of less than 5 seconds may be more sensitive to diagnose DED.¹² Slit lamp examination in DED patient may reveal a low tear lake at the inferior eyelid margin. A tear meniscus height of less than 0.25 mm has been considered for the presence of DED.

The preservative added lubricants, antibiotic or corticosteroid eye drops used in early post-operative period may induce toxic epitheliopathy and disturb tear film stability. Hence it is preferable to use preservative free new fortified artificial tears, a lubricant that containing demulcents and HP-guar, which binds to the hydrophobic tear surface and creates a gel. They can help to prevent premature tear breakup and can give a relief. The poor

visual acuity in post-operative period. then recommend visual acuity testing before and 15 minutes after installations of artificial tear drops. If visual acuity is improved and symptoms are reduced or eliminated then DED is a likely factor.

Post-surgical decreased corneal sensation and reduced tear production and blink rate lasting 6-18 months or more are evidence of neurotrophic DES. Damage to afferent sensory fibres resulting in dry eye has been reported after corneal incision surgery that is limbal cataract incision.

The pathogenesis of dry eye is complex and it involves any or all of the following: inflammation of the conjunctiva, cornea and tear film, decreased aqueous tear production, alteration in corneal sensitivity and reflex tear evaporation, eye lid punctum abnormalities, tear hyperosmolarity and ocular surface inflammation.

Corneal sensitivity at the centre and temporal incision sites had decreased sensitivity significantly at first post-operative day. However, the sensitivity returns to normal preoperative level in one month post operatively. The mean postoperative Schirmer's value results were no different from preoperative values.

The consistent abnormal reduced Schirmer's test I is highly suggestive of a tear production abnormality. Post cataract surgery tear osmolarity remain elevated for 4-5 weeks. In the post-operative period, the tear osmolarity increased to the value of 318.9 millimoles.¹³

DED is a multifactorial disease of the ocular surface and tears, which can lead to discomfort, visual disturbance and permanent damage to the ocular surface. Cataract surgery can induce dry eye or it may exacerbate the existing dry eye in the post-operative period.

While evaluating for cataract patients especially in chronic inflammatory and infective disease of the eye leading to cataract formation, the Schirmer's test I, tear breakup time assessment to be done before cataract surgery otherwise in postoperative period the aggravation of DED resulting in corneal complications and disturbance in visual recovery.

TBUT of less than 10 seconds in 5 minutes is indicative of DED.¹⁴

Preoperatively treat DED as per severity scale and treatment regimen suggested by Delphi panel in 2006.¹⁵ Mild dry eye (level 1) with artificial tears and environmental management, moderate DED (level 2) by preservative free tear substitute increased frequency, and severe DED (level 4) cyclosporine 0.05% eye drops plus punctal occlusion

Montes-Mico calculated that anterior radius of curvature of the tear film from 7.8 mm to 7.6 mm, as would be expected in DED, will change around 1.30 diopter power resulting in post operatively residual astigmatism and ametropia.¹⁶

Donnenfeld et al., showed that in cataract surgery patients in controlling inflammation by cyclosporine 0.05%, and topical steroids reducing signs and symptoms in DED patients in two weeks. Various studies have estimated the prevalence of DES to be between 5% and 34% of the population. As per one study by Donnenfeld et al. they found

that cyclosporine 0.05% compared to artificial tears improved significantly mesopic and photopic contrast sensitivity with improved visual acuity in case of multifocal IOL implanted eyes.^{17,18}

In preoperative surgical plan in case of DED prevention in post-operative period to some extent by using preservative free eye drops that is avoiding benzalkonium chloride and chlorbutanol in antibiotic eye drops and tetracaine ophthalmic topical anaesthetic eye drops respectively. This prevents drops induced toxicity to corneal epithelium in the postoperative has less toxic to the corneal epithelium than benzalkonium chloride.^{18,19}

Before implanting intraocular lens especially with multifocal intraocular lens, tear film abnormalities to be identified and treated.¹⁹

In case of multifocal IOL patients before applying YAG laser capsulotomy or IOL exchange, identify all tear film abnormalities.²⁰

Cyclosporine 0.05% twice a day along with steroid eye drops will reduce the inflammation in the post-operative period and reduces significantly the signs and symptoms of dry eye.²¹

Ram et al. In 23 post cataract surgery patients demonstrated the decreased Schirmer's score and tear break up time at various time points up to two months post-operative compared to preoperative values. Li et al., in 37 post cataract surgery patients found decrease Schirmer's values one week, one month and three months' time points compared to preoperative values.

Studies have shown that cataract surgery worsen dry eye symptoms in patients with preexisting DES and induces dry eye symptoms in patients without preexisting DES in at least first 2 months post surgery.^{22,23}

Cho et al. compared the incidence and severity of postoperative dry eye symptoms in cataract patients with and without a preoperative dry eye diagnosis. This study showed that patients with known preoperative dry eye had significant aggravation of dry eye symptoms and decreased tear meniscus post operatively, which the patients without preoperative dry eye had significantly worse dry eye symptoms, tear breakup time and aqueous tear production after phacoemulsification.

Asymptomatic dry eye disease in cataract patient is high in prevalence. The asymptomatic DED from becoming symptomatic after cataract surgery. Patients must be explained about postoperative aggravation of DED symptoms before doing cataract surgery.

Slit lamp examination in DED may reveal low tear lake at the inferior eye lid margin. A tear meniscus height of less than 0.25 mm has been shown to have good specificity and sensitivity for the presence of DED.

The ocular surface disease related symptoms like irritation, burning, redness, foreign body sensation, excessive tearing and visual fluctuation should be given importance in preoperative period itself. These symptoms may be present sometimes without clear cut clinical signs for DED and may get manifested or aggravated after cataract surgery. These presence of symptomatology patients to be

treated in the preoperative stage itself with adequate anti-inflammatory, steroid eye drops and tear substitutes.

73% of the cataract surgery is now clear corneal surgery which disturb the corneal nerves to a large amount, result in dryness due tear film disturbances. Subsequently the visual functions decrease in the expected post-operative period. 59% of people undergoing cataract surgery suffer from blepharitis probably due to old age poor lid and personal hygiene, superadded diabetes leading to staphylococcal blepharitis, as well as meibomianitis (MGD). This trouble must be treated in preoperative period itself so that in early post-operative period complications like endophthalmitis, aggravation of dry eye in postoperative period can be avoided.

Surgical trauma may result aqueous tear deficiency by scarring of tear ducts. This process destroys the mucin producing goblet cells and cause anatomical abnormalities of the conjunctiva, preventing proper tear distribution.

CONCLUSION

Since cataract surgery has been shown to induce or exacerbate preexisting DED, it is essential to have vigilance for DED when evaluating cataract surgery patients, to plan surgery accordingly, to select an appropriate IOL and to treat DED in preoperative and postoperative period.

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