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A Comparitive Study of Dry Eye Incidence among Patients Subjected To Phacoemulsification Vs Small Incision Catarct Surgery and an Assessment of the Effect Of 1% Carboxymethyl Cellulose Eye Drops On Post Operatvie Ocular Comfort and Tear Film Stability

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ABSTRACT
Aim: To compare the incidence of dry eye in patients undergoing phacoemulsification vs small incision cataract surgery (SICS) and to assess the effect of 1% carboxymethylcellulose (CMC) eye drops on postoperative ocular comfort and tear film stability.
Materials and Methods:104 eyes of 99 patients who had underwent phacoemulsification or SICS and had preoperative Schirmer Test -1(ST-1) values >/= 10 mm, Tear film Breakup Time(TBUT) >/=10 seconds, preoperative conjunctival impression cytology(CIC) showing grade 2 or less were included in the study and were classified into 4 groups. Each group of patients were randomised into two groups in which one group received 1% CMC eyedrops in addition to conventional treatment. Patients were assessed at 1 week, 1 month and 3 months postoperatively for modified OSDI questionnaire, ST – 1 and TBUT. CIC was done at 1 month and 3 months postoperatively.
Results: The incidence of dry eye as per ST-1 was statistically insignificant within the groups (P value >0.05). The maximum incidence was seen at 1 week in SICS groups followed by phacoemulsification groups ((7.7%) and (3.8%)). By the end of 3 months dry eye almost disappeared. The incidence of dry eye as per TBUT was statistically significant in all groups, peaking at 1week and was maximum in SICS groups (C (69.2%), and D (42.3%)). This gradually decreased by 3 months. The mean OSDI score showed a statistically significant change in all four groups. The peak of mean OSDI score and maximum incidence was observed at 1 week after which it reduced to baseline levels. CIC showed significant worsening at 1month postop period followed by a partial recovery at 3 months in all four groups.
Conclusion:According to our study, we conclude that Phacoemulsification resulted in lesser incidence and severity of dry eye than SICS. The addition of 1% CMC in treatment helped in reducing ocular discomfort in early postoperative period. The dry eye parameters showed a worsening in the early postoperative period, but reverted to preoperative levels at the end of 3 months following any technique of cataract surgery.

KEY WORDS: Small Incision Cataract Surgery (SICS), Phacoemulsification, dry eyes, carboxymethyl cellulose, tear film stability, Conjunctival Impression Cytology(CIC).

I. INTRODUCTION

Dry eye syndrome (DES) is a multifactorial disease of precorneal tear film that results in ocular discomfort, visual disturbance and tear film instability with potential damage to ocular surface.[(1)]There are many causes and factors leading to dry eye, including ageing, menopause, connective tissue diseases, diabetes mellitus, systemic hypertension, contact lens usage, drugs like antihistamines, anticholinergics, antidepressants, oral contraceptives and topical eye drops containing preservatives and ocular diseases like blepharitis, chronic conjunctivitis, meibomitis and pterygium.[(2-5)]Some surgical interventions related to anterior segment may also cause dry eye and aggravate the symptoms in pre-existing dry eye, like PRK, LASIK and cataract surgery.[(3,6-7)]Cataract surgery has been shown to develop or worsen the dry eye symptoms, with dry eye being one of the most frequent complaints in the post-operative period.[(8)].In conventional cataract surgery, a large incision is made at the limbusdenervating the superior half of cornea

leading to corneal desensitisation with subsequent complications. In the post-operative period, prolonged use of antibiotics and steroid drops with preservatives along with the presence of sutures further aggravates the dry eye condition. In phacoemulsification, the size of the incision is smaller, surgical time is reduced and there is milder postoperative inflammation [(9)]

II. MATERIALS AND METHODS:

Randomized, prospective, comparative, interventional study which included 104 eyes of 99 patients who were planning to do undergo cataract surgery, SICS or phacoemulsification from August 2019 to August 2020. The study was approved by Institutional Review Board and was adherent to the tenets of Declaration of Helsinki. Patients opting for phacoemulsification were randomised into 2 groups using simple random sampling with computer generated random numbers, Group A (Only conventional therapy given post operatively) and Group B (conventional therapy and 1% CMC given post operatively)

Patients undergoing small incision cataract surgery were also randomised into Group C (conventional therapy) and Group D(conventional therapy and 1% CMC given postoperatively). Those with cataract due to aetiology other than age, any lid surgery, intraocular, extraocular or refractive surgeries in the past, history of contact lens use, history of chronic ocular medications, history of any ocular conditions like allergic or infective conjunctivitis, keratitis, scleritis or uveitis, lid abnormalities like lagophthalmos, entropion or ectropion, allergy to the study medications, usage of systemic drugs that can that contribute to dry eye like antihistamines decongestants and antidepressants.

Data regarding demographic parameters such as age, sex, address were noted on a predesigned proforma at the time of first visit. All patients were assessed with history and asked to fill up modified OSDI questionnaire, complete ophthalmic evaluation, ST-1, TBUT preoperatively, postoperative 1 week, postoperative 1 month and postoperative 3 months. Patients were also subjected to CIC preoperatively,postoperative 1 month and 3 months period. All CIC slides were examined by the same pathologist who was blinded to the origin of the slides. All surgeries were done by the same surgeon.

III. STATISTICAL ANALYSIS

The obtained data was tabulated on Microsoft Excel spreadsheet and subjected to analysis using Open Domain statistical software. The continuous data was expressed as mean and standard deviation. The categorical data was expressed as ratios and percentages. Pie charts, bar diagrams and line diagrams were used to represent the data. Pearson's Chi- square test, Cochran's Q test and one way ANOVA were used as tests of significance. At 95% confidence interval, the probability value (P value) of less than 0.05 was considered to be statistically significant.

IV. RESULTS

In our study, 56.7% of the subjects were in the age group 45- 60 years, 40.4% were in the age group 61- 70 years, and 2.9% were more than 70 years of age group .The gender distribution of subjects were 47.11 % male and 52.89% female.

As per the results of ST-1, the incidence of dry eye peak (fig 1) was observed in all groups postop 1 week, which was maximum in groups C and D, followed by group B and A. At postop 1 month, the maximum incidence was seen in groups B and C. At the end of 3 months, dry eye disappeared in all groups except in group B and C. But there was no statistical difference between the groups by Cochran Q test (P value >0.05).

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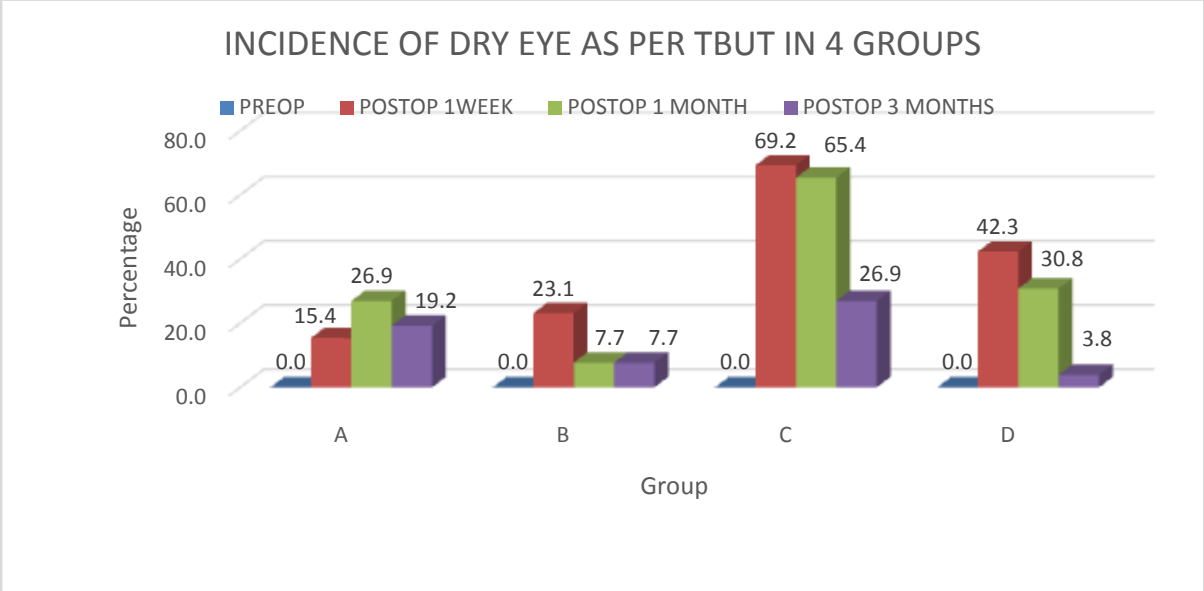

Figure 1: Incidence of Dry Eye in percentage as per ST- 1

On the analysis of incidence of dry eye as per TBUT score by Cochran's Q test, a statistically significant difference was observed within all 4 groups (Fig 2). The maximum of incidence was seen in group C followed by group D, group B and group A at postop 1 week. At 1 month follow up, this had decreased in all groups except A. A further decrease in the incidence of dry eye was observed in the 3 month follow up.

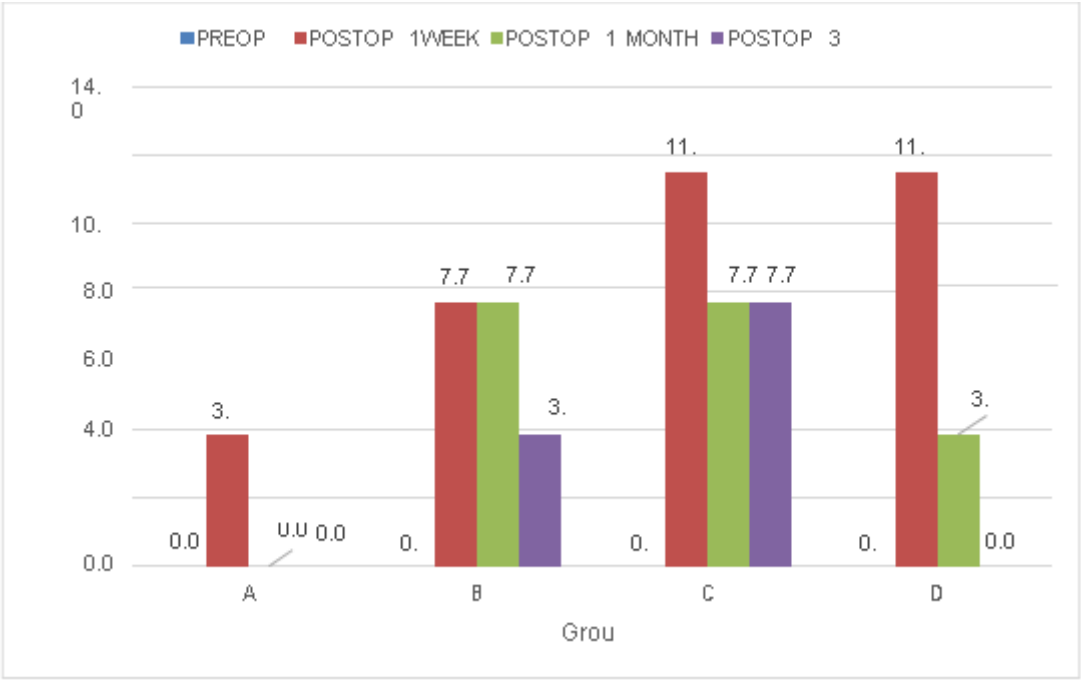

Figure 2: Incidence of Dry eye in percentage as per TBUT

There is statistically significant difference in mean OSDI between groups (fig 3) in postoperative 1 week, 1 month or 3 months by one way ANOVA test (P value <0.05). There is a significant rise at postop 1 week in groups A and C, followed by gradual decline at 3 months. Repeated measure ANOVA also showed significant change in mean OSDI score in all groups (P value< 0.05).

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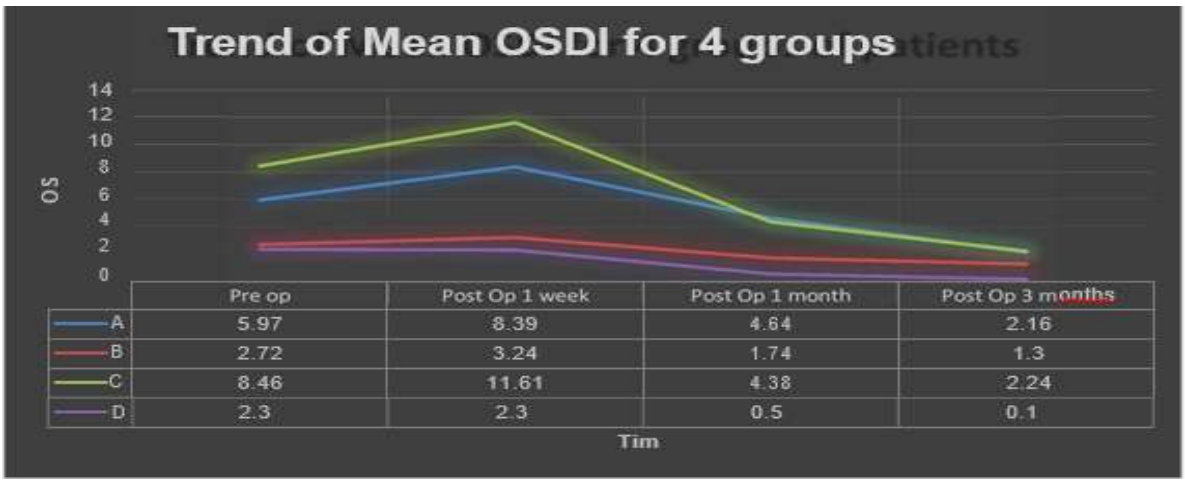
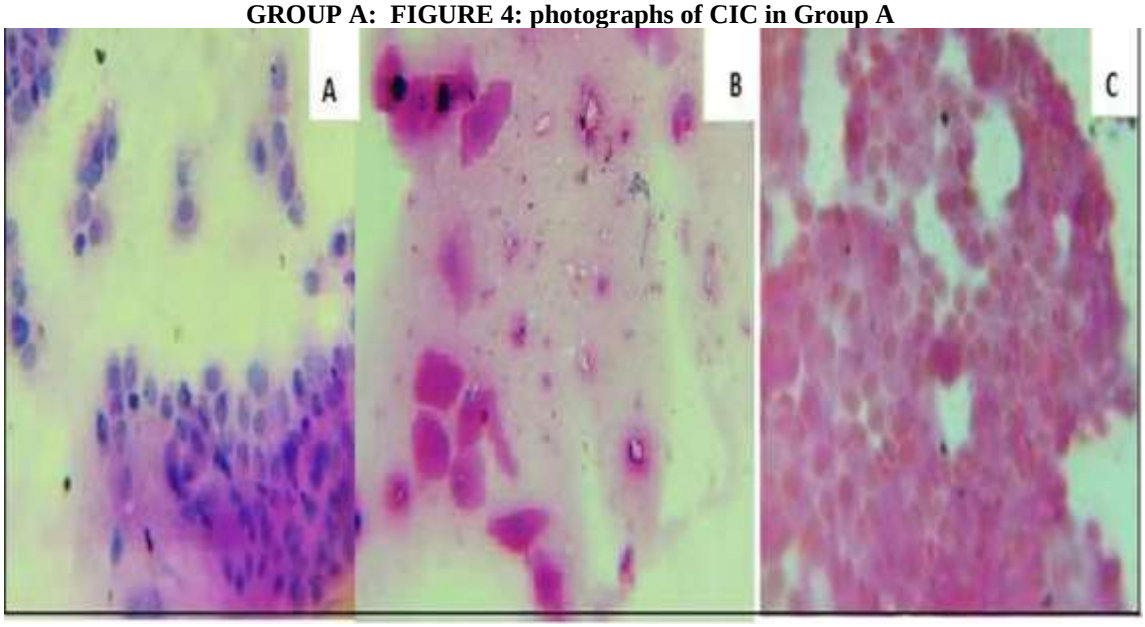


Figure 3: Trend of Mean OSDI for 4 groups of patients

	GROUP A			GROUP B			GROUP C			GROUP D		
	GRADE 1	GRADE 2	GRADE 3	GRADE 1	GRADE 2	GRADE 3	GRADE 1	GRADE 2	GRADE 3	GRADE 1	GRADE 2	GRADE 3
PREOP	19	7	0	22	4	0	23	3	0	19	7	0
POSTOP 1 MONTH	7	17	2	16	8	2	15	9	2	11	11	4
POSTOP 3 MONTHS	15	10	1	14	12	0	12	13	1	15	10	1

Table 1 shows distribution of grades of conjunctival impression cytology in different groups of patients preoperatively, postoperative 1 and 3 months.

GROUP A: FIGURE 4: photographs of CIC in Group A



(A) Preop: Grade 1 with sheets of polygonal epithelial cells. N:C ratio is1:2
(B) Postop 1 month: Grade 2 with larger epithelial cells with N:C ratio1:5
(C) Postop 3 months: Grade 1 with small and round epithelial cells with N:C ratio1:3

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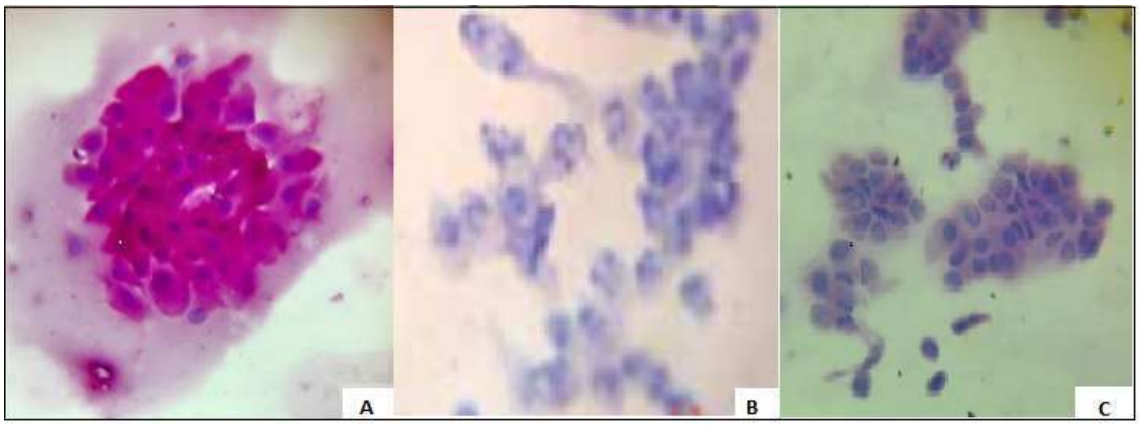
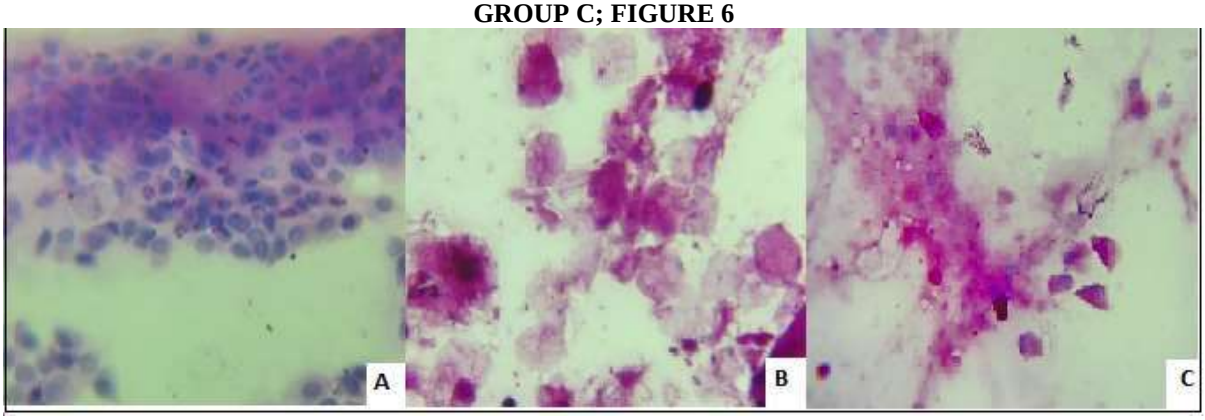
GROUP B: FIGURE 5



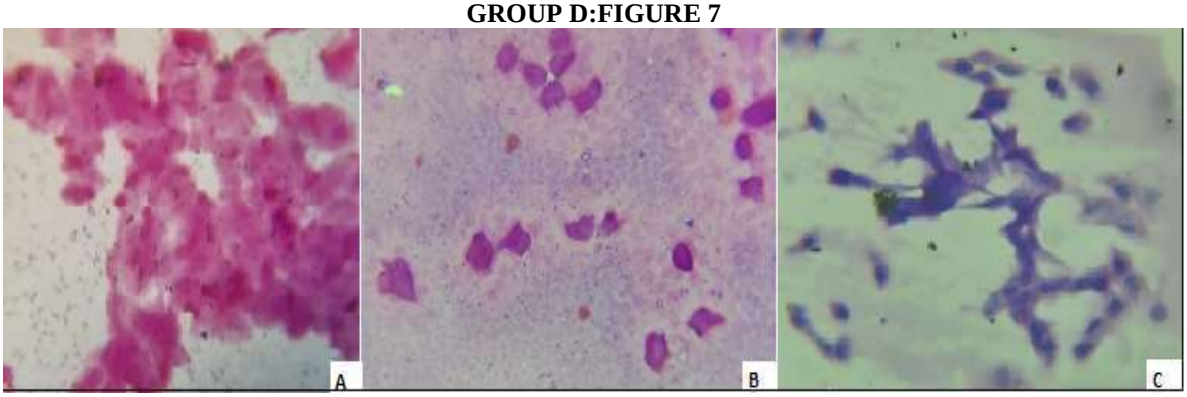
(A) Preop: Grade 1 with sheets of small, round epithelial cells, eosinophiliccytoplasmand basophilic nucleus. N:C ratio is1:3
(B) Postop 1 month: Grade 2 with larger epithelial cells with N:C ratio1:4
(C) Postop 3 months: Grade 1 with small and round cells with N:C ratio1:2

GROUP C; FIGURE 6



(A) Preop: Grade 1 with sheets of small, round epithelial cells, eosinophilic cytoplasm and basophilic nucleus. N:C ratio is1:2
(B) Postop 1 month: Grade 3 with larger epithelial cells with small, picnotic nucleus. N:C ratio1:6
(C) Postop 3 months: Grade 2 with bigger polygonal cells with N:C ratio1:4

GROUP D:FIGURE 7



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(A) Preop: Grade 1 with sheets of epithelial cells, eosinophilic cytoplasm. N:C ratio is1:2

(B) Postop 1 month: Grade 3 with larger epithelial cells with small, picnotic nucleus. N:C ratio1:6

(C) Postop 3 months: Grade 2 with bigger polygonal cells with N:C ratio1:4

V. DISCUSSION

Clinical evaluation of dry eye after cataract surgery has demonstrated worsening of patient subjective symptom scores, reductions in TBUT and goblet cell density, as well as increased corneal and conjunctival staining, indicating deteriorating disease[10-12]. Various factors may further impact the health of the ocular surface following cataract surgery, including age, the external environment, poor systemic health, concurrent ocular surface disease, reflex secretory block caused by nerve injury, and ocular epithelial injury during the operation[1, 11].

Topical anesthesia and eye drops containing preservatives like benzalkonium chloride are well known to have effects on the corneal epithelium[12,13] Exposure to light from the operating microscope might also be associated with postoperative dry eye[12]. Most corneal surgical procedures disrupt the normal organization of the corneal innervation, and this result in pathologic changes of the cornea and attendant discomfort[14]

Jagat Ram et al did a study which included 25 eyes of 23 patients with dry eye having phacoemulsification. Twenty-two eyes had predominant aqueous deficiency (Schirmer I with Xylocaine score of 5.0 mm or less), and 3 had a Schirmer score between 6.0 mm and 9.0 mm. The TBUT was 5 seconds or less in 17 eyes and between 6 seconds and 9 seconds in 8 eyes.[15]

NgmajitKasetsuwan et al conducted a study to evaluate the incidence and severitypattern of dry eye after phacoemulsification. Seven days after phacoemulsification, the incidence of dry eye was 9.8%. The severity of dry eye peaked 7 days post phacoemulsification and was measured by OSDI score, TBUT, Oxford ocular surface staining system and ST-I without anesthesia. Within 30 days and 3 months post-surgery, both the symptoms and signs showed rapid and gradual improvements, respectively[16]

Mohana Sinha et al in 2014 conducted a study to compare dry eye disease following SICS and Phacoemulsification.Both SICS and phacoemulsification surgery caused significant decrease in Tear Meniscus Height, TBUT and ST-I values at 1 week, 1 month and 3 months. Fluorescein staining, OSDI score and IC also showed deterioration in the follow up period. Both SICS and phacoemulsification surgery can cause or aggravate dry eye and affect the dry eye test values in the post-operative period up to 3months[17]

Li et al in 2017 conducted a study on 37 patients (50 eyes) were by using a 25-item National Eye Institute Visual Function Questionnaire (NEI-VFQ25) and OSDI 3 days before and 1 week, 1 month, and 3 months after cataract surgery. Slit-lamp microscope examination, cornea and conjunctiva fluorescein staining, TBUT, ST-1 and Impression Cytology (IC) were carried out at the same time. After cataract surgery, the incidence of dry eye increased dramatically; NEI-VFQ25 and OSDI indicated that most patients developed this symptom after surgery. The lacrimal river line became narrow, and TBUT and ST-1 decreased in patients after cataract surgery. IC suggested the presence of serious squamous metaplasia in the epithelial layer of the globe conjunctiva, especially the lower lid region[10].

Ishrat et al conducted a study to identify the incidence and pattern of dry eye after phacoemulsification and SICS. OSDI, TBUT and ST- 1 were used to record the type of dry eye in 100 eyes of 96 patients. Dry eyes were found in 42% of eyes (P=0.001) of patients at 1 week follow up. 15% and 9% of eyes were dry at 1 month and 3 months after surgery respectively. There were 34 (53.1%) and 8(22.2%) dry eyes in SICS and phacoemulsification groups respectively at 1week post-operative follow up which was astatistically significant difference. Majority of eyes had mild dryness. Incidence of dry eye is higher in SICS than phacoemulsification.[18]

Ke Yao et al conducted a study to evaluate the efficacy and safety of 1% CMC combined with conventional therapy in treating dry eye signs and symptoms after phacoemulsification. TBUT was significantly longer in treatment group comparedtocontrolgroupatday7andday30.Compare d with baseline, TBUT significantly increased in patients in the treatment group ($P < 0.001$ at both day 7 and day 30) with a pre-surgical diagnosis of dry eye, but significantly decreased in patients in the control group ($P < 0.02$ at both day 7 and day 30) with no prior diagnosis of dry eye. Fluorescein and lissamine staining, OSDI questionnaire and subjective symptom scores all improved from baseline, with no significant differences between the two groups.[19]

Rita Mencucci et al in 2015 conducted a study to evaluate the efficacy and safety of using

sodium hyaluronate 0.1% and CMC 0.5% artificial tears for ocular discomfort and tear-film stability in eyes after cataract surgery in 282 patients. At 5 weeks, the mean TBUT was statistically significantly higher in the study group than in the control group (P=.0003). The mean OSDI score statistically significantly improved in both groups from 1 to 5 weeks (P < 0.0001 for both groups); however, there was no statistically significant difference between the groups at these time points. The artificial tears statistically significantly improved Visual Analog Scale-assessed dry-eye symptoms in the study group compared with the control group at 5 weeks (P < .001). The mean corneal fluoresce in staining was significantly reduced in the study group compared with the control group at 5 weeks (P =0.002 vs P=0.05), respectively. (20)

In our study, comparison of phacoemulsification and SICS, the incidence of dry eye as per ST-1 and TBUT was lower in phacoemulsification group. The mean OSDI scores were also lesser in phacoemulsification group. It shows that phacoemulsification resulted in lesser incidence and severity of dry eye than SICS.

On comparison of phacoemulsification groups without and with CMC given post-operatively, the incidence of dry eye as per ST-1 and TBUT did not show any significant difference. The CIC grades at 1 month were better in phacoemulsification group where CMC was given. With respect to OSDI, the scores were lesser in phacoemulsification group where CMC was given, which showed lesser ocular discomfort due to addition of 1% CMC following phacoemulsification surgery.

On comparison of SICS groups with and without CMC, the incidence of dry eye according to ST-1 did not show any statistically significant difference at any interval. But the incidence of dry eye as per TBUT and OSDI in was lesser in SICS with CMC group. Hence, the addition of 1% CMC in SICS patients provides improvement in dry eye symptoms and tear film stability in early postoperative period.

On assessing the ST- 1 scores among different groups, there was transient reduction in ST-1 in SICS groups at 1 week and in other groups we noticed a slight increase in the ST-1 score postoperatively. These values were not statistically significant.

The incidence of dry eye as per TBUT is statistically significant across the groups. The maximum incidence was seen in SICS groups (group C and group D). In our study, the incidence of dry eye as per TBUT was higher than the incidence of dry as per ST1 across all the groups.

On assessing OSDI scores of all groups, there was an increase in OSDI at postop 1 week after which OSDI score showed a downward trend reaching baseline levels by 3 months, thus concluding that the symptoms of dry eye following any technique of cataract surgery were maximum at one week postop, which decreased gradually over a period of 1-3 months reaching back to normal.

When comparing the grades of CIC in different groups, cytological changes had worsened at 1 month, followed by a partial recovery at 3 months postoperative period in all the groups.

VI. CONCLUSION

According to our study, we conclude that Phacoemulsification resulted in lesser incidence of dry eye than SICS. The addition of 1% CMC in treatment helped in reducing ocular discomfort in early postoperative period. The dry eye parameters showed a worsening in the early postoperative period, but reverted to preoperative levels at the end of 3 months following any technique of cataract surgery.

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