Original Article

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Anaesthesia Section

Efficacy of Eyelid Taping with and without Ocular Lubricants in Patients Receiving General Anaesthesia: A Prospective Interventional Study

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ABSTRACT

Introduction: Corneal Abrasion (CA) is the most common ophthalmic complication that occurs after General Anaesthesia (GA) in non ocular surgeries. GA results in reduced basal tear volume, loss of light reflex, and lack of pain perception, resulting in corneal drying. This makes the cornea susceptible to abrasion and keratitis. Research suggests that preventing corneal mechanical exposure and providing artificial tears can help mitigate these risks.

Aim: The aim of this study was to assess the efficacy of eye taping with and without Hydroxypropyl Methylcellulose (HPMC) drops in preventing perioperative CA.

Materials and Methods: This prospective comparative interventional study was conducted in the Department of Anaesthesia, Justice Hegde KS Charitable Hospital in Mangaluru, India, from June 2021 to November 2021. A total of 122 patients who underwent GA for non ocular surgeries lasting more than 45 minutes were grouped into group T or group D, depending on whether their eyes were only taped during GA (T) using hypoallergenic adhesive tape or had HPMC drops instilled in their eyes along with tape (D). Participants were evaluated 2 and 12 hours after the end of GA in the postanaesthesia care unit using a questionnaire to assess eye symptoms. Conjunctival hyperaemia and chemosis were evaluated using scoring systems. Other parameters noted included age, gender distribution, type, and duration of surgery. Statistical analysis using the chi-square test/likelihood ratio was performed to assess the association between the eye protection method used and postsurgical outcomes.

Results: Out of the 122 patients who received either of the two eye protection methods under GA, 68 (55.7%) were females and 54 (44.3%) were males. A total of 85 (69.6%) were between the ages of 20-60 years, while 29 (23.8%) were above the age of 60 years. There was no statistically significant association found between the age or gender of the patients and the eye protection method used. No statistically significant difference was noted between the duration, type of surgeries, and the eye protection method used in this study. There was no statistical significance (p-value >0.05) noted with respect to the conjunctival hyperaemia and chemosis scoring in the two groups. However, 15 (24.6%) patients in group D were found to have adhesive lids two hours postsurgery. There was an association (p-value <0.05) between the occurrence of adhesive lids at two hours postsurgery and the eye protection method used.

Conclusion: Eye protection is mandatory in all non ophthalmic cases under GA. Both eyelid taping alone and eyelid taping with HPMC drops are equally effective in preventing perioperative ocular injury.

Keywords: Corneal injuries, Eye protective devices, Perioperative period

INTRODUCTION

Ocular injury following General Anaesthesia (GA) is not uncommon [1]. Corneal Abrasion (CA), defined as a defect in the corneal epithelium, is the most common ophthalmic complaint following non ocular surgeries in the postoperative period [2-5]. Symptoms of CA include redness, blurred vision, foreign body sensation, tearing, pain, and light sensitivity of the eye [6]. Eye protection methods during GA usually consist of surgical taping of eyelids or the use of general-purpose adhesive dressings, specialised eye occlusion dressings, eye patches, ointments, or suturing the eyelids closed [7]. As a standard practice during GA, eye protection is initiated after the patient is intubated. Lubricating eye drops such as 2% HPMC or paraffin-based ointments are instilled into both conjunctival sacs, and then the eyelids are taped shut [5-7].

Reported literature shows the incidence of CAs under GA to be between 0.013-0.17% when the eyes were shut by taping after the instillation of eye ointment [8-12]. The incidence of corneal complications was found to be 0.17-3.30% when taping the eyes without lubricants and tear substitutes, with reported incidence of damage to the corneal epithelium ranging from 0.17-6.6% [12,13]. Regardless of the eye protection methods used in the form of lubricant drops and ointments, GA reduces basal tear production, and corneal defects were noted on fluorescein staining of the cornea before and after surgery [13]. The incidence in unprotected eyes is reported to be 44% [14]. The eye protection strategies employed during anaesthesia can have their own complications such as corneal damage, chemosis, allergies, eyelid bruising, and loss of eyelashes [15-17]. This risk may increase in elderly patients, people with sensitive skin, dehydration, dermatitis, or adverse effects to the applied drugs [18]. Commercially, special dressings for eyelid occlusion like EyePro®, EyeGuard®, EyeLocc®, Hydrogel eye dressing, and Anaesthesia-Aid® are now available [19,20]. There are mixed reports in the literature regarding different perioperative eye protective strategies. Current recommendations suggest keeping the eyes closed with tape, and when this is not practical, instilling a bland ophthalmic solution [21]. Systematic reviews highlight the lack of gold standards in perioperative eye care and suggest more research on specific prevention strategies, evaluating the risk factors, preventative steps, and treatments for perioperative corneal injuries during non ocular surgery [22].

Since CA is a preventable complication, understanding the need for eye protection, the efficacies, and drawbacks of different protective

methods will decrease ocular morbidity under GA. The purpose of the present study was to evaluate the adequacy of the two standard eye protection methods used during GA. The first method was eyelid taping without tear substitutes, and the second method was instilling 2% HPMC drops before taping the eyelids shut. The hypothesis of the current study was that both methods were equally effective.

MATERIALS AND METHODS

The present prospective comparative interventional study was conducted Department of Anaesthesia, Justice Hegde KS Charitable Hospital in Mangaluru, India, from June 2021 to November 2021. The study was conducted after clearance from the Institutional Ethical Committee (INST.EC/EC/087/2021-22, REG.NO.EC/NEW/INST/2020/834), and written and informed consent was obtained from the study participants.

Sample size calculation: Based on the study conducted by Kocaturk O et al., at a 5% level of significance and 80% power, the required sample size per group was 61, and the total sample size was 122 [23]. The proportion of patients in adhesive tape group (T) was 0.12, and the proportion of patients in the artificial tear drops group (D) was 0.33. The estimated risk difference was -0.21, calculated using nMaster software version 2.0. The study population consisted of patients scheduled for elective non ophthalmic surgery under GA in a supine position lasting more than 45 minutes.

Inclusion criteria: All adult patients aged 18 years or older scheduled for non ophthalmic surgeries under GA in supine position were included in the study.

Exclusion criteria: Patients who refused to consent for the study, patients with dry eye syndrome and pre-existing corneal diseases, patients on ocular medications, patients with connective tissue disorders, thyroid ophthalmopathy, pregnant females, patients with cranial nerve palsies, and Horner's syndrome were excluded from the study. Patients requiring lateral and prone surgical positions were also excluded.

Study Procedure

General anaesthesia was instituted according to the institutional protocol. The eye protective method was initiated immediately after the loss of consciousness at the induction of GA. The study participants received eye protection in the form of taping the eyes shut with hypoallergenic adhesive tape or the application of hypoallergenic tape to the eyes after the instillation of HPMC drops. At the end of the procedure, before the reversal of GA, the eye tapes were removed.

Participants were evaluated 2 and 12 hours after the end of GA in the Postanaesthesia Care Unit using the following questionnaire, and the response with Yes (Y) or No (N) was documented [23].

Questionnaire [23]:

- Adhesive lids (Inability of patients to open eyes due to sticking of upper and lower eyelids and presence of sticky glue on the eyelashes) - Y/N
- Foreign body sensation - Y/N
- Itching- Y/N
- Burning- Y/N
- Stinging- Y/N
- Photophobia- Y/N
- Blurred vision- Y/N
- Dryness- Y/N

Participants were also evaluated using the conjunctival hyperaemia scoring system [Table/Fig-1] and chemosis scoring system [Table/Fig-2] [23]. On detection of any abnormalities, participants were referred for thorough ocular examination and care.

Conjunctival hyperaemia scoring system	
Score	**Description**
1	Hyperaemia located only in the temporal or nasal areas of bulbar conjunctiva
2	Hyperaemia located in the nasal or temporal areas plus extension to the upper or the lower fornixes
3	Hyperaemia including all of the areas of bulbar conjunctiva

[Table/Fig-1]: Conjunctival hyperaemia scoring system.

Chemosis scoring system	
Score	**Description**
0	Absent
1	Mild (to grey line)
2	Moderate (to lid margin)
3	Severe (over lid margin)

[Table/Fig-2]: Chemosis scoring system.

STATISTICAL ANALYSIS

Data were expressed in terms of mean±Standard Deviation (SD) for continuous data or frequency percentage for categorical data. The data were analysed using an unpaired t-test or Mann-Whitney U test for continuous variables and Chi-square test/likelihood ratio for categorical variables. A p-value <0.05 was considered statistically significant. The data analysis was performed using the Statistical Package for the Social Sciences (SPSS) software version 20.0.

RESULTS

A total of 244 eyes (122 patients) were assessed for the efficacy of two different eye protection strategies under GA in the present study. Of the 122 patients, 61 had their eyelids taped shut during GA (group T), and 61 had their eyelids taped after instillation of HPMC drops (group D). No patients complained of eye discomfort before anaesthesia. Patients were evaluated 2 and 12 hours postanaesthesia.

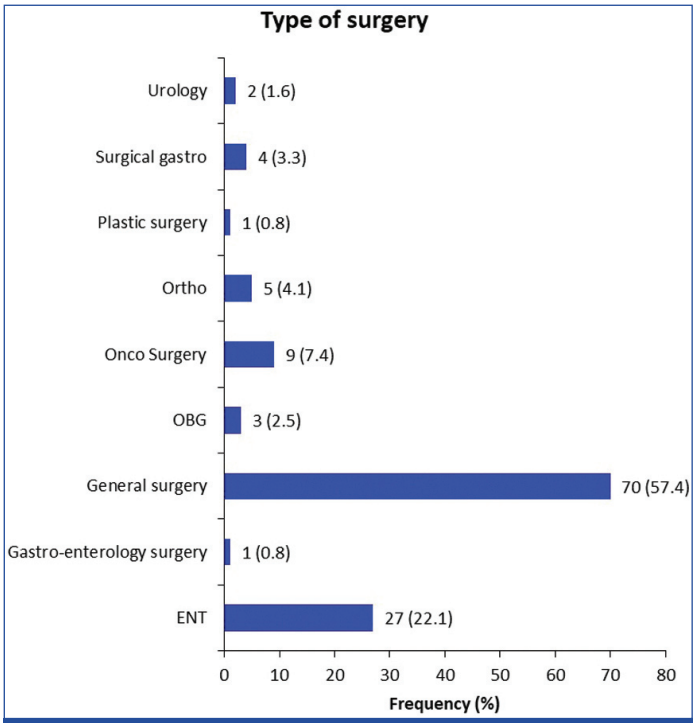
Among the 122 patients, 8 (6.6%) were aged less than 20 years, 29 (23.8%) were above 60 years of age, and 85 (69.6%) were aged between 20-60 years. There were 54 (44.3%) male patients and 68 (55.7%) female patients. The gender distribution for the type of eye protection method used in both groups (group T and group D) was equal. Surgical duration was noted to be between 60-180 minutes in 68 (27.85%) cases, between 180-240 minutes in 26 (21.3%) cases, and more than 240 minutes in 27 (22.1%) cases [Table/Fig-3].

Variables		Eye protection methods		Chi-square/ Likelihood ratio#	p-value
		Group D n (%)	Group T n (%)		
Age (years)	<20	3 (4.9)	5 (8.2)	2.301#	0.512
	20-40	16 (26.2)	22 (36.1)		
	41-60	26 (42.6)	21 (34.4)		
	>61	16 (26.2)	13 (21.3)		
Gender	Female	34 (55.7)	34 (55.7)	0	1
	Male	27 (44.3)	27 (44.3)		
Duration of surgery in minutes	<60	1 (1.6)	0	3.636	0.457
	60-120	13 (21.3)	20 (32.8)		
	120-180	20 (32.8)	15 (24.6)		
	180-240	13 (21.3)	13 (21.3)		
	>240	14 (23.0)	13 (21.3)		

[Table/Fig-3]: Comparison of age, gender and duration of surgery between tape+HPMC and tape alone group (minutes) (n=122).

Seventy cases (57.4%) belonged to general surgery, twenty-seven (22%) were from ENT specialty, and the rest of the cases were distributed across various specialties such as onco-surgeries, orthopaedics, obstetrics, and plastic surgery as shown in [Table/Fig-4]. No association (p-value <0.05) was found between age,

gender, duration of surgery, type of surgery, and the eye protection methods used under GA.



[Table/Fig-4]: Distribution of the participants in terms of type of surgery (n=122).

In group T, 35 (57.4%) patients had no conjunctival hyperaemia, 21 (34.4%) had hyperaemia located only in the nasal or temporal area of the bulbar conjunctiva (score 1), and 5 (8.2%) had hyperaemia extending to the fornixes (score 2). In group D, 38 (62.3%) had no conjunctival hyperaemia, 17 (27.9%) had score 1 hyperaemia, and 6 (9.8%) had score 2 hyperaemia. The chemosis score was 0 in all patients in both the groups [Table/Fig-5].

Characteristics		Eye protection methods		Chi-square/ Likelihood ratio#	p-value
		Group D n (%)	Group T n (%)		
Adhesive lids	Yes	15 (24.6)	0	17.103	<0.001*
	No	46 (75.4)	61 (100)		
Foreign body sensation	Yes	4 (6.6)	4 (6.6)	0#	1
	No	57 (93.4)	57 (93.4)		
Itching	Yes	4 (6.6)	3 (4.9)	0.152#	0.697
	No	57 (93.4)	58 (95.1)		
Burning	Yes	1 (1.6)	0	1.395#	0.238
	No	60 (98.4)	61 (100)		
Stings	No	61 (100)	61 (100)	--	--
Photophobia	Yes	0	1 (1.6)	1.395#	0.238
	No	61 (100)	60 (98.4)		
Blurred vision	Yes	1 (1.6)	0	1.395#	0.238
	No	60 (98.4)	61 (100)		
Dryness	No	61 (100)	61 (100)	--	--
Conjunctival hyperaemia score	1	17 (27.9)	21 (34.4)	0.635	0.728
	2	6 (9.8)	5 (8.2)		
	Absent	38 (62.3)	35 (57.4)		
Chemosis score	0	61 (100)	61 (100)	--	--

[Table/Fig-5]: Comparison of postsurgical (two hours) characteristics according to eye protection methods (n=122).

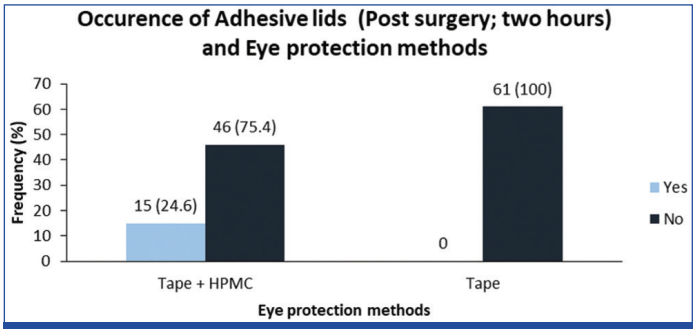
Four patients (6.6%) in both groups reported foreign body sensation, while one patient (1.6%) in group D reported burning of eyes and blurring of vision. No patients complained of stinging of eyes, photophobia, or dryness of eyes in either group. However, in group D, 15 (24.6%) patients complained of adhesive lids, which was statistically significant (p-value <0.001), while no patients had a similar complaint in group T.

At 12 hours postanaesthesia, in group T, 58 (95.1%) had no conjunctival hyperaemia, and 3 (4.9%) had score 1 hyperaemia. In group D, 56 (91.8%) had no conjunctival hyperaemia, and 5 (8.2%) had score 1 hyperaemia score of 1 [Table/Fig-6]. None of the patients developed chemosis, and no other ocular complaints were reported 12 hours postsurgery and GA. There was no association between the occurrence of conjunctival hyperaemia and chemosis and the eye protection method used (p-value >0.05).

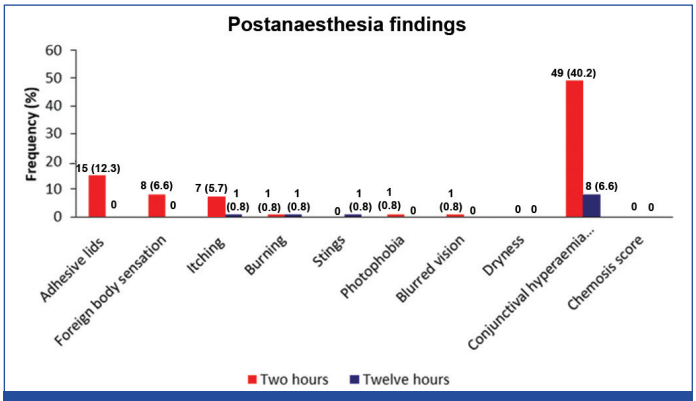
Characteristics		Eye protection methods		Likelihood ratio	p-value
		Group D n (%)	Group T n (%)		
Adhesive lids	No	61 (100)	61 (100)	--	--
Foreign body sensation	No	61 (100)	61 (100)	--	--
Itching	Yes	1 (1.6)	0	1.395	0.238
	No	60 (98.4)	61 (100)		
Burning	Yes	1 (1.6)	0	1.395	0.238
	No	60 (98.4)	61 (100)		
Stings	Yes	0	1 (1.6)	1.395	0.238
	No	61 (100)	60 (98.4)		
Photophobia	No	61 (100)	61 (100)	--	--
Blurred vision	No	61 (100)	61 (100)	--	--
Dryness	No	61 (100)	61 (100)	--	--
Conjunctival hyperaemia score	1	5 (8.2)	3 (4.9)	0.54	0.462
	Absent	56 (91.8)	58 (95.1)		
Chemosis score	0	61 (100)	61 (100)	--	--

[Table/Fig-6]: Comparison of postsurgical (twelve hours) characteristics according to eye protection methods (n=122).

The Chi-square/Likelihood ratio test was used to compare the postsurgical (two hours) characteristics, and the likelihood ratio test was used to compare the postsurgical (twelve hours) characteristics according to the eye protection methods [Table/Fig-7,8].



[Table/Fig-7]: Comparing the occurrence of adhesive lids between tape+HPMC and tape alone group (postsurgery; two hours).



[Table/Fig-8]: Bar graph showing postanaesthesia findings.

DISCUSSION

The present study aimed to compare the incidence of ocular surface disorders in patients receiving GA using two common perioperative methods of eye protection. Patients were evaluated for eye discomfort using questionnaires 2 and 12 hours postanaesthesia, and conjunctival hyperaemia and chemosis were scored.

The main finding in the current study was an increased incidence (24.6%) of adhesive lids in 15 patients who received HPMC drops along with taping compared to patients who had only tapes applied as an eye protective strategy. This was found at the two-hour evaluation postanaesthesia. In a comparison of postanaesthesia characteristics done 2 and 12 hours apart according to eye protection methods, there was an association (p-value <0.05) between the occurrence of adhesive lids at two hours postanaesthesia and eye protection, but remaining symptoms had no association (p-value >0.05) with the eye protection method used.

A similar incidence was found in the study conducted by Smolle M et al., in which the incidence of adhesive lids in the ointment group was higher compared to the clear hydrogel group (p-value <0.001) [24]. This may be due to gluing of the eyelids. According to Bøggild-Madsen NB et al., HPMC causes eyelid gluing, which protects the eye mechanically, but this might also be the reason for adhesive lids [25].

The blurry vision and sticky eye found in the group with tape and HPMC drops may cause postoperative anxiety in susceptible patients like the elderly and very young upon emergence from anaesthesia. Hence, it should be addressed with careful wiping of the sticking glue adherent to the eyelids before waking up the patient.

In the present study, the incidence of symptoms which were possible indicators of Corneal Abrasion (CA) (burning and itching) were similar in both groups. This study did not find any association between the eye protective strategy used and age, gender, type, and duration of surgery.

The questionnaire and scoring system used in the current study were similar to the study conducted by Kocaturk O et al., where four eye protective methods were compared [23]. They included artificial tear liquid gel containing polyacrylic acid, an ocular lubricant, hypoallergenic adhesive tape, and antibiotic ointment. The antibiotic group complained of significant blurred vision, and the artificial tear liquid gel group had a high incidence of conjunctival hyperaemia (22.8%) and chemosis (33.69%).

In a study conducted by George TA et al., the need for eye protection during GA was evaluated, and the efficacy of various eye protection methods was assessed [1]. They used a 2% HPMC tear substitute ointment, paraffin-based lubricant eye ointment, hypoallergenic sticky surgical paper tape, and combinations of these ointments to tape the lids [1]. They performed fluorescein staining of the cornea and Schirmer's test to measure basal tear volume before and after surgery. They concluded that the percentage of difference in Schirmer's test score pre and postoperatively was almost the same in all groups, and all eye protection methods were equally effective. The results are comparable to the current study; however, basal tear secretion was not checked, and subjective and objective evaluations were done for CA in the current study.

Lee SJ et al., compared four eye protection methods to prevent CA. Group 1 had careful manual eye closure, group 2 had adhesive tape, group 3 had ointment applied, and group 4 had ointment and tape [26]. They did not notice any statistically significant conjunctival hyperaemia scale in all four groups when the conjunctiva was observed by slit lamp examination.

The application of lubricant drops does not necessarily provide ocular protection during GA. Careless and improper application can outweigh the benefits. It can add an unnecessary cost burden, and if the same drops are used on multiple patients, it might carry a risk of eye infections in susceptible populations. Taping of the eyes should be done appropriately over the skin overlying the tarsal plate, as incorrect placement can lead to eyelash depilation due to residual glue tapes sticking to the eyelashes [7].

In a case-controlled study by Carniciu AL et al., done to identify risk factors associated with perioperative CA at a single hospital, it was concluded that pre-existing ocular illness and longer surgical procedures are risk factors for perioperative CA [27]. Surgical duration played a significant role in perioperative eye injuries, as concluded by Roth S et al., in a study on eye injuries during anaesthesia in 60,965 patients [9,28]. The surgical duration in this study was in the range of 60 minutes to 240 minutes, and we found no association between the surgical duration and perioperative eye injuries (p-value=0.457).

It should be noted that the duration of action of 2% HPMC ophthalmic solution is about 45-60 minutes [1]. Hence, taping the eyes shut immediately after the loss of consciousness seems to be the most ideal method of guarding the eyes against anaesthesia-induced damage, regardless of lubricant use. However, if the patient has preexisting dry eye detected preoperatively, a lubricant eye solution should be applied post-induction. It may need to be administered repeatedly every hour if the surgical duration is prolonged [29].

Incidents of eye discomfort may be missed because patients may not be fully conscious, especially in the second hour after anaesthesia. They may ignore the eye discomfort compared to the pain caused by surgical wounds. In the current study, eye discomfort was assessed at 2 and 12 hours postanaesthesia, and it is suggested that a change in vision in non ocular surgeries requires a high degree of clinical suspicion as it may be mistaken for residual anesthetic effects [30].

webAIRS, a voluntary de-identified anaesthesia incident reporting system, identified potential risk factors, treatments, and outcomes associated with CA and found that painful eyes were the most common postoperative finding. This usually subsided with the use of lubricant and antibiotic drops within 48 hours [31]. Retrospective reviews conducted as quality improvement projects suggest simple standardised strategies for perioperative CA prevention, diagnosis, and treatment plans [32]. However, professional anaesthesia organisations lack endorsed guidelines, position statements, or standards for CA prevention, leaving its prevention and treatment to individual anaesthesia providers [3].

Limitation(s)

The present study only used subjective and objective methods to assess postoperative assessment of CA rather than using slit lamp examination after fluorescein staining. Basal tear production was not checked using Schirmer's test. Patients who underwent surgeries in prone or lateral positions were not assessed.

CONCLUSION(S)

During GA eyes need to be protected either by applying appropriate tapes or using a combination of tapes and ocular lubricant drops to prevent corneal damage. In the present study, adhesive lids were observed at 2 hours postanaesthesia in group D, which was statistically significant. It is concluded that both eye protection methods used in the present study are equally effective in preventing perioperative ocular morbidity under GA. No superiority was found between eyes protected with tape alone, or tape with HPMC drops. Perioperative corneal injuries are easily preventable, and anaesthesia providers should remain vigilant and take appropriate measures to prevent postoperative ocular morbidity.

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