Clear hydro-gel, compared to ointment, provides improved eye comfort after brief surgery

[Un hydrogel clair, comparé à une pommade, améliore le confort après une brève intervention chirurgicale]

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Purpose: Anesthesia impairs lid closure and decreases tear secretion and stability. Protection may, in principle, be conveyed by manual eye closure, taping the eyelids closed, and by instillation of protective substances into the conjunctival sac. Both hydro-gels and ointments are used in clinical practice. It was the objective of the present study to compare a transparent clear ocular hydro-gel (Vidisic®) and a commonly used dexpanthenol and vitamin A (Oleovit®) based ointment as examples of these classes of ocular lubricants in their capability to provide perioperative eye comfort. Furthermore, their bacteriostatic properties were assessed *in vitro*.

Methods: Ninety-two consecutive patients undergoing total *iv* general anesthesia were randomly allocated to receive either ocular dexpanthenol ointment or a clear hydro-gel after induction of anesthesia. Subjects were assessed one hour following termination of anesthesia.

Results: Main findings were an increased incidence of foreign body sensation, adherent eyelashes and disturbance elicited by blurred vision in the ointment group as compared to clear hydro-gel ($P < 0.001$). Bacterial growth was significantly attenuated by the ocular hydro-gel as compared to ointment.

Discussion: Clear ocular hydro-gel offers improved patient comfort and decreased ocular inflammation as compared to conventional eye ointments. In addition, it decreases bacterial growth. Therefore, the use of clear ocular hydro-gel for perioperative ocular comfort is suggested.

Objectif : *L'anesthésie gêne la fermeture des paupières et diminue la sécrétion et la stabilité lacrymales. On peut, en principe, protéger l'œil par sa fermeture manuelle, une bande adhésive sur les paupières closes et l'instillation de substances protectrices dans le sac conjonctival. Notre objectif était de comparer deux substances représentant des classes de lubrifiants oculaires utilisés en clinique, un hydrogel oculaire clair et transparent (Vidisic®) et une pommade, à base de dexpanthénol et de vitamine A (Oleovit®) couramment utilisée, quant à leur capacité à améliorer le confort après une opération. Nous voulions aussi évaluer leurs propriétés bactériostatiques in vitro.*

Méthode : *Quatre-vingt-douze patients consécutifs devant subir une anesthésie générale exclusivement iv ont reçu aléatoirement la pommade oculaire au dexpanthénol ou un hydrogel clair, après l'induction de l'anesthésie. Les sujets ont été évalués une heure après la fin de l'anesthésie.*

Résultats : *Nous constatons principalement une incidence accrue de sensation de corps étranger, d'adhérence des cils palpébraux et de trouble provoqué par une vision floue avec la pommade comparée à l'hydrogel ($P < 0,001$). Nous notons aussi avec l'hydrogel, comparé à la pommade, une réduction significative de la croissance bactérienne.*

Discussion : *L'hydrogel oculaire clair offre un meilleur confort et réduit l'inflammation de l'œil, comparativement aux pommades traditionnelles. De plus, il diminue la croissance bactérienne. On peut donc suggérer l'usage d'hydrogel oculaire clair pour améliorer le confort périopératoire.*

DEPENDING upon risk factors, up to 44% of unprotected eyes may be subjected to corneal trauma during general anesthesia.[1] Ocular injuries, among them especially corneal abrasions, are frequent and potentially important complications of general anesthesia.[2] Major pathogenetic factors are a perioperative decrease in tear secretion and stability,[3] and the ability

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of general anesthesia to impair ocular reflexes and eye closure.[4] Subsequently, corneal injury and kerato-conjunctivitis sicca may occur, leading to considerable pain and discomfort. In the presence of contamination, severe infection may ensue.[5]

Therefore, the value of ocular protection in the prevention of corneal injuries has been acknowledged repeatedly. Among the strategies used in perioperative care, simple manual closure of the eyelids, taping the eyelids closed, and the instillation of protective substances into the conjunctival sac are most commonly employed.[4]

Substances in frequent use today include hydrogels and ointments. However, bacteriostatic properties, patient comfort, and ability of the anesthesiologist to assess pupillary dilation have been described as different for these two groups of substances.[4,5]

It was the objective of the present study to compare a transparent clear ocular hydro-gel (Vidisic®, Mann Pharma, Berlin, Germany) and a commonly used dexpanthenol and vitamin A based ointment (Oleovit®, Fresenius Kabi, Linz, Austria) as examples of these classes of ocular lubricants, in their capability to (a) ensure perioperative ocular comfort; and to (b) impair bacterial growth *in vitro*.

Methods

Clinical study

Ninety-two consecutive patients undergoing elective urologic and neurosurgical interventions under general anesthesia were enrolled. Informed consent was obtained from each patient according to Institutional Review Board Guidelines. The anticipated length of operations was between 45 and 120 min. Exclusion criteria were surgery in the prone position, facial injuries, current ophthalmologic disease, and inability to complete the questionnaire. Premedication consisted of 7.5 mg of oral midazolam one hour preoperatively. A standard anesthesia protocol was followed and routine monitoring applied. Anesthesia was in the supine position with the patient's head on a pillow 5 cm in height. Oxygen was administered via a face mask. Two minutes later, anesthesia was induced using *iv* fentanyl (2 $\mu g \cdot kg^{-1}$) and propofol (2–3 $mg \cdot kg^{-1}$) mixed with lidocaine 25 mg given over 30 sec. Total *iv* anesthesia with remifentanil and propofol was used for maintenance of anesthesia. Face mask ventilation was commenced and continued for at least 30 sec until relaxation with rocuronium (0.6 $mg \cdot kg^{-1}$) was suitable for endotracheal intubation.

Patients were randomly allocated to receive either 40 mg of ointment (n = 46, "ointment" group) or two drops of hydro-gel (n = 46, "gel" group) after induction of anesthesia using a random allocation sheet. Eyes were taped closed during surgery.

One hour after surgery, an investigator blinded to group allocation completed a questionnaire together with the patients. Patients were questioned concerning ocular burning/itching sensations, eye dryness, blurred vision and its perception, and foreign body sensation. The investigator assessed conjunctival inflammation (increased tearing, redness of the eyes), adhesive lids (difficulty of lid opening upon verbal command) and lid swelling. Answers were rated on a scale consisting of 1 (yes), 2 (rather yes), 3 (rather no), and 4 (no).

In vitro study

One gram of ocular hydro-gel, 1 g of ointment, or agar (control) were inoculated with 10 mL of Staphylococcus (S.) aureus suspension containing approximately 10^2 bacteria for 14 hr at 37°C (n = 2). Subsequently, 100 µL of each culture broth were plated onto a blood agar and incubated for 24 hr at 37°C. Main variable was the number of colony-forming units (CFU).

Statistical analysis

We calculated that a sample size in each of the two groups of 46 would allow detection of a decrease in the incidence of ocular discomfort of 25% (reduction from 35% to 10%) using a two sided 0.05 level Chi square test with a power of 80%.

Demographic data were analyzed using descriptive statistics, the unpaired (two-tailed) Student's t test and the Chi square test. Answers to the questionnaires were analyzed using a Chi square test. Statistical significance was assumed at $P < 0.05$. All statistical calculations were carried out using the statistical package SPSS for Windows 11.0 software (Chicago, IL, USA).

Results

There were no significant differences between the two groups in age, gender and duration of surgery (Table I). Mean duration of surgery was 63 ± 23 min.

Based upon clinical examination, none of the 92 patients enrolled in the present study sustained corneal abrasion during surgery. No significant differences in subjective assessment could be found for ocular burning, eye dryness, and itching sensations. Patients in the group receiving ointment reported foreign body sensations significantly more often compared to patients treated with clear hydro-gel ($P < 0.001$). The incidence of adherent eyelashes and blurred vision was higher in the ointment group ($P < 0.001$). Moreover, the level of disturbance attributed

TABLE I

Sample characteristics

			Hydro-gel	*Ointment*	*P value*
Age		Mean (range)	53.6 (25-83)	53.4 (25-77)	0.972
Gender	Female	*n*	18	20	0.832
	Male	*n*	28	26	

TABLE II

Postoperative eye symptoms

		*1** *n (%)*	*2** *n (%)*	*3** *n (%)*	*4** *n (%)*	*P value*
Ocular burning	Group G	0 (0.0%)	1 (2.2%)	0 (0.0%)	45 (97.8%)	NS
	Group O	0 (0.0%)	0 (0.0%)	2 (4.3%)	44 (95.7%)	
Eye dryness	Group G	0 (0.0%)	2 (4.3%)	0 (0.0%)	44 (95.7%)	NS
	Group O	0 (0.0%)	0 (0.0%)	1 (2.2%)	45 (97.8%)	
Itching sensation	Group G	0 (0.0%)	0 (0.0%)	1 (2.2%)	45 (97.8%)	NS
	Group O	0 (0.0%)	0 (0.0%)	0 (0.0%)	46 (100.0%)	
Foreign body sensation	Group G	0 (0.0%)	0 (0.0%)	1 (2.2%)	45 (97.8%)	< 0.001
	Group O	2 (4.3%)	9 (19.6%)	6 (13.0%)	29 (63.0%)	
Conjunctival inflammation	Group G	0 (0.0%)	1 (2.2%)	0 (0.0%)	44 (95.7%)	NS
	Group O	0 (0.0%)	1 (2.2%)	1 (2.2%)	44 (95.7%)	
Adherent eyelashes	Group G	0 (0.0%)	1 (2.2%)	0 (0.0%)	45 (97.8%)	< 0.001
	Group O	7 (15.2%)	10 (21.7%)	2 (4.3%)	27 (58.7%)	
Lid swelling	Group G	0 (0.0%)	0 (0.0%)	0 (0.0%)	46 (100.0%)	NS
	Group O	1 (2.2%)	1 (2.2%)	1 (2.2%)	43 (93.5%)	
Blurred vision	Group G	0 (0.0%)	0 (0.0%)	0 (0.0%)	46 (100.0%)	< 0.001
	Group O	9 (19.6%)	17 (37.0%)	4 (8.7%)	16 (34.8%)	
Is blurred vision disturbing?	Group G	0 (0.0%)	0 (0.0%)	0 (0.0%)	46 (100.0%)	< 0.001
	Group O	2 (4.3%)	6 (13.0%)	10 (21.7%)	28 (60.9%)	

*Answers were marked on a scale ranging from 1 (yes); 2 (rather yes); 3 (rather no); to 4 (no).
Group G = hydro-gel; Group O = ointment; NS = not significant.

to blurred vision was also higher in these patients ($P < 0.001$). Detailed results are presented in Table II.

Seventeen CFU of S. aureus were counted on the agars incubated with hydro-gel-containing broth, as compared to a microbial film on the agars incubated with ointment-containing broth and a dense microbial film in controls.

Discussion

Our study aimed to investigate perioperative ocular comfort comparing a clear hydro-gel with a protective ointment. The main findings were an increased incidence of foreign body sensation, adherent eyelashes, blurred vision, and disturbance elicited by blurred vision in the ointment group as compared to clear hydro-gel ($P < 0.001$).

The importance of corneal injury is highlighted by the fact that 16% of closed claims following corneal injuries brought before American courts had permanent sequelae.[2]

The human cornea is physiologically protected by a tear film consisting of three layers. The innermost mucin layer acts as the interface between the tear film and the corneal surface. The aqueous layer is responsible for oxygen supply to the central area of the cornea, host defense, and the removal of foreign bodies. Finally, the outermost lipid layer decreases evaporation and increases tear surface tension.[4]

The incidence of corneal abrasions during general anesthesia has been reported as up to 44% in unprotected eyes featuring lagophthalmus,[1] whereas rates as low as 2.1% have been reported following protection using ointments.[6] The peak incidence of corneal injury during general anesthesia occurs between 90 to 150 min.[4]

Eye dryness was not significantly different between the two groups. This issue is of clinical significance since dry corneal tissue may result in visual disturbances, susceptibility to trauma, and, in the presence of contamination, infection.[4] Therefore, the ideal protective

substance instilled into the conjunctival sac should possess bacteriostatic properties. Our findings suggest that the antibacterial properties of hydro-gel against the frequent and potentially dangerous contaminant S. aureus are more pronounced than those of ointment.

Burning and itching sensations, possibly indicative of corneal abrasions, were not different in the two groups. Similarly, conjunctival inflammation was similar in both groups. However, the incidence of painless foreign body sensation, a frequent and disturbing symptom, was significantly higher in the ointment group.

Blurred vision, a frequent cause of postoperative patient anxiety, was significantly less frequent in the hydro-gel group. Moreover, the degree of blurred vision was described as more intimidating by subjects in the ointment group. The property of conventional ointments to obscure the pupil is important for patients. Elderly and very young patients may develop considerable anxiety on emerging from anesthesia with insufficient vision.

Protective ointments do not convey absolute ocular protection during general anesthesia. Potentially adverse effects of careless ointment application can outweigh their protective properties, as highlighted by Siffring.[7] Moreover, inflammation of the conjunctiva and swollen lids may occur following administration of ocular ointments.[8]

Finally, the limitations of our study should be addressed. Patients were questioned one hour postoperatively. This time-point allows for an involvement of the patient in the assessment of eye protection measures. In contrast, other studies were performed intraoperatively,[8] or without a definite time-point for the patient interview.[5] Nevertheless, the possibility of patient confusion as a confounding variable in the present investigation cannot be excluded. In concordance with previous reports, we made no attempt to alter premedication.[5] Furthermore, it should be noted that significant correlations between the length of surgery and the occurrence of eye injuries have been reported.[9] Therefore, the results from the present study might not be applicable for longer operations.

In conclusion, ocular hydro-gel offers improved patient comfort and decreased ocular inflammation as compared to a conventional eye ointment. It also decreased bacterial growth *in vitro*. Therefore, the use of clear hydro-gel for perioperative ocular protection is suggested.

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