

# Prevention of exposure keratopathy in intensive care unit

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## Abstract

- **AIM:** To compare the efficacy for preventing exposure keratopathy of three forms of eye care (artificial tear, moist chamber and polyethylene covers) for intensive care patients.

- **METHODS:** Eighty-four patients in Intensive Care Unit (ICU) were randomized to three treatment groups, including artificial tears group, moist chambers group and polyethylene film group. Patients of artificial tear group received two drops of carboxymethylcellulose drops to each eye every 2 hours. The moist chambers and the polyethylene were changed every 12 hours or as needed if they became unclean or torn. The corneal fluorescein stains were performed daily.

- **RESULTS:** No of 28 patients (0%) in the polyethylene group and one of the 27 patients (3.70%) in the moist chamber group had exposure keratopathy, compared to 8 of the 29 patients (27.59%) in the artificial tear group. There were statistical significance between the artificial tear group and the moist chamber group ( $P=0.02$ ), and the artificial tear group and the polyethylene group ( $P=0.003$ ). The time on eye care every day of the artificial tear group, the moist chamber group and the polyethylene group was  $26.69 \pm 2.39$  minutes,  $35.33 \pm 2.63$  minutes and  $7.48 \pm 0.87$  minutes, respectively. The eye care of the polyethylene group were statistically more time-save than that of the artificial tear group ( $P < 0.001$ ) and the moist chamber group ( $P < 0.001$ ).

- **CONCLUSION:** Polyethylene covers are more effective and more time-saving in reducing the incidence of corneal damage in intensive care patients

- **KEYWORDS:** exposure keratopathy; critical care

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## INTRODUCTION

Medical and nursing staff in intensive care unit (ICU) concentrate the majority of their efforts on problems seen as immediately life-threatening. This may lead to lack of attention to other serious issues<sup>[1]</sup>. These patients in ICU, due to impairment of protective eye mechanisms, are susceptible to corneal dehydration, abrasions, corneal perforation and infection. The reported incidence for exposure keratopathy ranges from 20 to 42%<sup>[2-4]</sup>, within a relatively short time, ranging from 2 and 7 days in ICU<sup>[3,4]</sup>.

Since moist chambers and lubrication are two of the most common methods for preventing exposure keratopathy, polyethylene film is a new method applied to preventing exposure keratopathy. In order to evaluate the effectiveness in preventing exposure keratopathy, we compared the three methods: artificial tears (carboxymethylcellulose drops), traditional moist chambers and polyethylene film covers.

## MATERIALS AND METHODS

**Materials** Patients were recruited from ICU if they were aged over 18 years, mechanically ventilated and unconscious, as assessed by the bedside nurse. The frequency of eye opening was limited to less than five blinks per hour. Exclusion criteria were patients with a pre-existing eye condition.

**Methods** The ICU patients meeting the inclusion criteria were simply randomized to the three treatment groups, artificial tears group, moist chambers group and polyethylene film group. All patients received a standard eye cleansing regime of washes to the external eye using 9g/L saline and sterile gauze before every treatment. Patients randomized to artificial tear group received two drops of carboxymethylcellulose drops to each eye every 2 hours. Patients of moist chambers group had moist chambers sealed by adhesive tape to cover the eye. The patients of polyethylene film group had pieces of polyethylene (3M Healthcare) cut to cover the eye from the eyebrow to the cheekbone. The moist chambers and the polyethylene were changed every 12 hours or as needed if they became unclean or torn. Patients completed the study if they regained spontaneous eye opening, were discharged from the facility

**Table 1 Comparison of mean age, study length and time on eye care every day**

Groups	n	Age (yr)	Study length (h)	Eye care time (min/d)
Artificial tear	28	54.5±18.2	143.6±103.0	26.7± 2.4
Moist chamber	27	56.0±16.2	157.9±103.9	35.3± 2.6
Polyethylene	29	55.2±18.8	153.6±94.3	7.5± 0.9 <sup>b</sup>

<sup>b</sup>*P*<0.01 vs both artificial tear group and moister chamber group

during study enrolment, died or developed a corneal ulcer or eye infection.

The cornea was assessed by instillation of fluorescein and viewing with cobalt blue light using an indirect ophthalmoscope and 20 dioptr lens. The corneal fluorescein stains were performed daily on all patients enrolled in the study. Any patient found to have a compromised cornea was removed from the study and treated with prophylactic antibiotic ointment.

**Statistical Analysis** One-way analysis of variance, Tukey's multiple comparison tests and Chi-square test were used to evaluate the differences by SPSS 10.0 software. *P* <0.05 was considered statistically significant.

## RESULTS

Eighty-four patients were recruited for the study. After randomization, 29 patients were assigned to artificial tear group, 27 patients to moist chamber group and 28 patients to polyethylene group. The average age and mean study hours showed no statistically significant difference among the three groups (Table 1). No patients (0%) in the polyethylene group and one of the 27 patients (3.7%) in the moist chamber group had exposure keratopathy, compared to 8 of the 29 patients (27.6%) in the artificial tear group. There were statistical significance between both the artificial tear group and the moist chamber group ( $\chi^2=5.91$ , *P*=0.02), and the artificial tear group and the polyethylene group ( $\chi^2=8.99$ , *P*=0.003). However, there was no statistical significance between the moist chamber group and the polyethylene group ( $\chi^2=1.06$ , *P*=0.30).

The time on eye care every day of the artificial tear group, the moist chamber group and the polyethylene group was 26.7±2.4 minutes, 35.3±2.6 minutes and 7.5±0.9 minutes, respectively. There was statistical significance among three groups (*F*=1264.17, *P*<0.001, Table 1). The eye care of the polyethylene group were statistically more time-save than that of the artificial tear group (*P*<0.001) and the moist chamber group (*P*<0.001).

## DISCUSSION

The cornea is an avascular layer of stratified, non-keratinised, non-secretory epithelium. It relies on a tear film to maintain adequate corneal wetting. Tears lubricate the ocular surface, providing oxygen to the cornea and washing away noxious stimuli and potential pathogens. The epithelia

of ocular surface produce mucins that hold tears onto the eyes. In addition, tears have bactericidal properties; proteins contained in tears, including lysozyme, lactoferrin, tear lipocalin, and secretory IgA help prevent infection<sup>[5,6]</sup>. Eyelid closure and blinking contribute to replenishing and spreading the tear film across the cornea and preventing tear film evaporation and keratopathy<sup>[7]</sup>. ICU patients are often paralysed and sedated leading to incomplete eyelid closure and unable blinking. Critical illness is frequently associated with capillary leak and fluid retention that causes peripheral oedema and conjunctival oedema and then may lead to inadequate eyelid closure. Additionally, sedation may result in a loss of the blink reflex and a lack of random eye movements. In addition, medications, such as antihistamines, atropine, phenothiazines and tricyclic antidepressants, can decrease secretions of tear. These factors seriously impair corneal and conjunctival surface defenses. As a result, these patients are susceptible to exposure keratopathy<sup>[4]</sup>.

In ICU, a variety of approaches have been used to maintain the tear film and prevent exposure keratopathy, including: artificial tears or ointment, lubricating prophylactic antibiotics, moist chambers, adhesive tape, eye patches, temporary sutures, and so on. Artificial tear and moist chamber were most regularly used. However, artificial tear wasn't so effective to prevent exposure keratopathy. In our study, there were 8 of 28 patients had exposure keratopathy in the artificial tear group, compared that no patient had exposure keratopathy in the polyethylene group and only one patient had exposure keratopathy in the moist chamber group. We found that moist chamber and polyethylene could provide greater protection than artificial tear. Moreover, the eye care of the polyethylene group were statistically more time-save than that of the artificial tear group (*P*<0.001) and the moist chamber group (*P*<0.001). The polyethylene was easier and more efficient to apply.

The polyethylene covering creates a moist chamber providing a barrier against tear-film evaporation and exposure to air currents. It may also keep the eye clean and closed by providing a physical barrier to organisms and preventing possible translocation of infections from sources such as the respiratory tract. Cortese *et al*<sup>[8]</sup> reported a trend for more patients to have a closed resting eye position when treated with polyethylene. Moreover, its transparency may

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facilitate assessment by allowing more frequent observation and monitoring of the cornea.

Additional considerations for clinical practice include the ease of application and expense associated with the three techniques. In a busy ICU environment, two-hourly eye drop or time-consuming traditional moist chamber is not always achieved due to factors such as additional procedures or operations being performed. During these times, failure to perform eye care may increase the risk of ulceration. However, time-saving polyethylene is easier to be performed and more advantageous. In conclusion, polyethylene covers are more effective, more time-saving and easier in reducing the incidence of corneal damage in intensive care patients, and it is deserved to be popularized in ICU.

### REFERENCES

- 1 Edwards JR, Peterson KD, Andrus ML, Tolson JS, Goulding JS, Dudeck MA, Mincey RB, Pollock DA, Horan TC: National healthcare safety network (nhsn) report, data summary for 2006, issued june 2007. *Am J Infect Control* 2007;35(5): 290–301
- 2 Hernandez EV, Mannis MJ: Superficial keratopathy in intensive care unit patients. *Am J Ophthalmol* 1997;124(2):212–216
- 3 Imanaka H, Taenaka N, Nakamura J, Aoyama K, Hosotani H: Ocular surface disorders in the critically ill. *Anesth Analg* 1997;85(2):343–346
- 4 Mercieca F, Suresh P, Morton A, Tullo A: Ocular surface disease in intensive care unit patients. *Eye (Lond)* 1999;13 ( Pt 2):231–236
- 5 McClellan KA: Mucosal defense of the outer eye. *Surv Ophthalmol* 1997;42(3): 233–246
- 6 Dua HS: Bacterial keratitis in the critically ill and comatose patient. *Lancet* 1998;351(9100):387–388
- 7 McHugh J, Alexander P, Kalhor A, Ionides A: Screening for ocular surface disease in the intensive care unit. *Eye (Lond)* 2008;22(12):1465–1468
- 8 Cortese D, Capp L, McKinley S: Moisture chamber versus lubrication for the prevention of corneal epithelial breakdown. *Am J Crit Care* 1995;4(6):425–428