Clinical Outcomes of Implementing Evidence Based Eye Care Intervention for Mechanically Ventilated Patients

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Abstract

Background: Regular eye care is important nursing intervention for effective clinical management of critically ill patients. Eye care can prevent dryness, damage to the eye, complications and infection. **This study aims to:** Evaluate clinical Outcomes of Implementing Evidence Based Eye Care Intervention for Mechanically Ventilated Patients. **Design**: Design of quasi-experimental research. **This research was conducted** in the Intensive Care Units of Assiut University Hospital. **Subjects**: This study included sixty recently admitted adult mechanically ventilated patients. Purposive sampling was taken in accordance with the inclusion criteria. **Three tools** were used to collect study data**. Tool I:** Patient assessment sheet. **Tool II:** Evidence Based Eye Care Intervention tool. **Tool III:** Clinical outcomes of implementing evidence based eye care intervention tool. **Method**: The evidence based eye care intervention for the study group was implemented and evaluated the occurrence of ocular surface disorders by using a fluorescein eye stain test. **Results:** A total of sixty patients. The outcomes revealed a significant reduction in the presence of ocular surface disorders after implementing an adult eye care intervention. Related to the right cornea, the results revealed P<0001 on the 5th day, while on the left cornea, the results revealed P = 0.015 on the 7th day. Regarding conjunctiva, the present finding showed P <0001 for both eyes on the 7th day. **Conclusion**: Implementing an evidence based eye care intervention diminished the occurrence of ocular surface disorders among mechanically ventilated patients. **Recommendation**: Regular and necessary eye care can lower the risk of eye complications and infection.

Keywords: Evidence based, Eye Care Intervention, Mechanically Ventilated Patients, Clinical Outcomes.

Introduction

Critically ill patients are more likely to develop eye complications as a result of their life-threatening disease, which includes a compromised immune response and exposure to environmental factors and pathogens [(1)]**.** Additionally, for intensive care patients reduced tear production, blinking, and closing the eye, it can cause eye dryness, infection, ulcerations. Eye care and a nursing care plan for every day must include regular eye exams. Iatrogenic ophthalmological problems are prevented (cleaning the eye with normal saline or sterile water, closing the eyelid with an ocular lubricant, or creating a moisture chamber with polyethylene wrap) [(2)]**.**

Hospitalized patients should have eye care, especially those in Intensive Care Units where the normal protective systems of the eye are frequently compromised. As a result of poor venous drainage, conjunctival edema, and chemosis, mechanically ventilated patients with positive end-expiratory pressure (PEEP) greater than 5 mmH2O may experience "ventilatory eye" and iatrogenic corneal damage. Patients who require frequent endotracheal suctioning is more likely to get an infection, especially if an improper technique is used [(3).]

The most common iatrogenic eye disorders among patients in Intensive Care Units (ICUs) are conjunctivitis, lagophtalmus, corneal abrasions, keratopathy, dry eye, microbial keratitis, and endophtalmitis, with a prevalence ranging from 3.6% to 89.3%. In the study by Sivasankar et al. on sedated patients in ICUs, Lagophtalmus was found in 20% to 75% of people. Between the second and seventh days in the hospital, mechanically ventilated patients had a 3 to 60% chance of developing ocular abrasions [(4).]

Eye care for the critically ill is a crucial practice due to high incidence and significant effect of iatrogenic eye diseases on their quality of life. When treating critically ill patients, the emphasis is frequently placed on illnesses that are life-threatening rather than eye care. According to all the research, a lack of appropriate recommendations has led to a lack of information about the significance of nursing eye care practices Nursing staff must adopt positive attitudes and behaviors to improve eye care in ICUs**[(5)].**

When a patient is admitted, as well as on a regular basis, such as at shift changeover, a thorough patient history and assessment should be completed. Critical care nurses should be aware that critical illness, pre-existing conditions, and intensive care treatment all increase the risk of iatrogenic eye complications. Early detection and treatment of OSD symptoms improves the condition's resolution [(6)]**.**

The patient's risk factors for OSD must be assessed by intensive care staff at the beginning of the care plan, and eyelid closure must be maintained on admission and routinely thereafter, such as at shift handover. The frequency of ocular assessments and eye care interventions should be documented in a care plan that is reviewed and updated on a regular basis. At least once per shift, the results of patient

assessments and the effectiveness of interventions should be documented. If the eyes cannot be closed passively, close the eyelids mechanically to protect the eye [7].

The aim of the study was to evaluate clinical outcomes of implementing evidence based eye care intervention for mechanically ventilated patients.

Three tools were used to collect study data. Tools were prepared by the researchers after reviewing the related literatures. [8, 9, & 10]

Tool I: Patient assessment sheet. This tool was developed to assess patient's status. It includes patient's sex diagnosis and risk factors of ocular disorders.

Tool II: Evidence Based Eye Care Intervention tool. This tool was designed based on the evidence.

Tool III: Clinical outcomes of implementing evidence based eye care intervention tool. This tool was design to assess eye closure, cornea disorders and conjunctival abnormalities, including chemosis, discharge.

Patients and method

- The current study was designed as a quasi-experimental research design after following the Declaration of Helsinki and obtaining ethical approval under the code 2790027 from the local ethics commission of the research in the faculty of nursing at Assiut University .

- Setting of the study: Adult ICUs in main Assiut University Hospital.

- **Study sample**: A purposive sampling of sixty patients was collected according to inclusion criteria as recent admission, mechanically ventilated comatose patients without spontaneous eye opening, and getting permission from first-degree relatives were the inclusion criteria. Eye injuries and other conditions affecting the ocular surface were excluded from this study.

The Epidemiology Information 2000 statistical software was used to calculate the sample size. The calculation was performed using the expected frequencies of critical care units from previous studies, with a 95% confidence interval, an 80% power of the study, a 95% prevalence of critically ill patients, and a 5% worst-case acceptable result. [11].

. According to the above criteria, the sample size was 54 critically ill patients.

The sample was divided into two equal groups of 30 patients each. The control group received routine hospital eye care, while the study group received an evidence-based eye care intervention.

The study was applied in the previous mention setting from February 2023, to July, 2023). The control group who received routine hospital eye care (cleaning of both eyes with warm water soaked gauze every 8 hours, if eye infection is suspected, commencing broad-spectrum topical antibiotic treatment and applying dressing made from gauze and cotton for eyes if grade II eye lid closure), and the study group who received a evidenced based of eye care intervention.

The validity of the study tools was verified by two ophthalmologist and three critical

care and emergency nursing department of the Assiut University.

- The Cronbach's alpha test was utilized to evaluate the reliability of study tools. Reliability coefficients for tools were 0.815, 0.787, and 0.910, confirming reliability. (12)

- Prior to the actual study, a pilot study was conducted on 10% of the patients to assess the feasibility and applicability of all tools, and simple tool modifications were made.

Implementing of evidence based eye care intervention

- An ophthalmologist in Assiut University Hospital's ICU trained the researcher on how to examine the eye and use a fluorescein eye stain test to detect any corneal complications.
- After developed and validated eyes care intervention, the researcher implemented it as the following:
  - The researcher assessed patient's risk factors for ocular surface diseases related to process diseases, treatment diseases and ICU environment.
  - The researcher assessed patient's ability to maintain eyelid closure to determine degree of eye exposure from the first day of admission for seven consequent days.
  - The researcher assessed each patient's eye independently (examine lids, conjunctiva, and pupil) from the first day of admission as a base line data for both groups.
  - To remove dried ointment from the eyes, first wash them with warm water before applying the next lubricant. Then, apply Sodium Hyaluronate 2.0 eye drops (Hyfresh eye drops) to each patient's eye independently to maintain moisture of eyes for mechanically ventilated patients, then, apply polyethylene eye cover to each patient's eye independently to maintain closed eye lid of mechanically ventilated patients to prevent corneal complications. Then, change polyethylene eye cover every 12 hours and or as needed if they became unclean or torn

Evaluating of the evidence based eye care intervention

- This phase was carried out to evaluate the impact of implementing evidence-based eye care interventions on preventing ocular surface disorders by using fluorescein eye stain test from the first day of intervention for both groups**.**
- The researcher assessed each patient's eye independently (examine lids, conjunctiva, and pupil) from the first day of admission as a base line data for both groups.
- The researcher used the fluorescein eye stain test from the first day of admission for seven consequent days. This is a test that uses orange dye (fluorescein) and pen torch to detect damage to the cornea.
- Put the end of the fluorescein strip on the surface of patient's eye, then was waited seconds until spread of the dye and coated the tear film covering the surface of the cornea.
- Shone pen torch at patient's eye. Any problems on the surface of the cornea stained by the dye and appear green under the pen torch.
- Determined incidence of OSDs (corneal abrasion or corneal ulcer etc.)

Statistical analysis:

- SPSS (ver.25) was used to computerize and analyze the data. Descriptive statistics

were used to present data, either as standard deviations and means for qualitative data or as frequencies and percentages for quantitative data. To compare quantitative data between two groups, the independent samples t-test was used. The chi-square test was used to compare qualitative variables in order to determine significance.

- When P was less than 0.05, the critical value of the tests, "P," was deemed statistically significant.

Results:

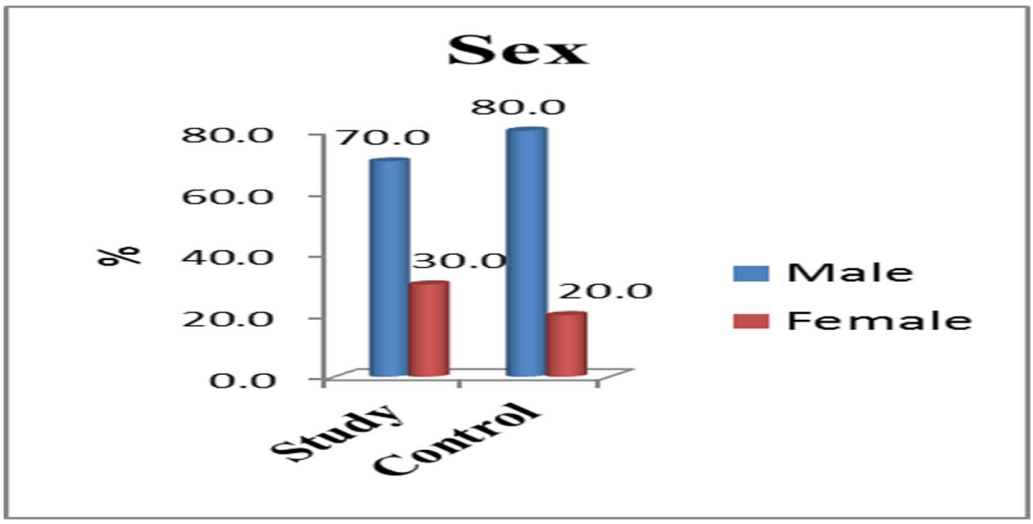
Figure (1) - A, B, C: for each type of eye care. The majority of the patients were male in two groups. The mean age of the patients in both groups was 42 years. The results revealed that just below the half of patients (46.7%) were complained from respiratory diseases in study group and CNS diseases in control group.

Figure (2) - it was noted that patients in both groups who were nearby shared the majority of risk variables. It was noted that one third (33.3%) of the study had peripheral or central neurological damage compared with (66.7%) of control group.

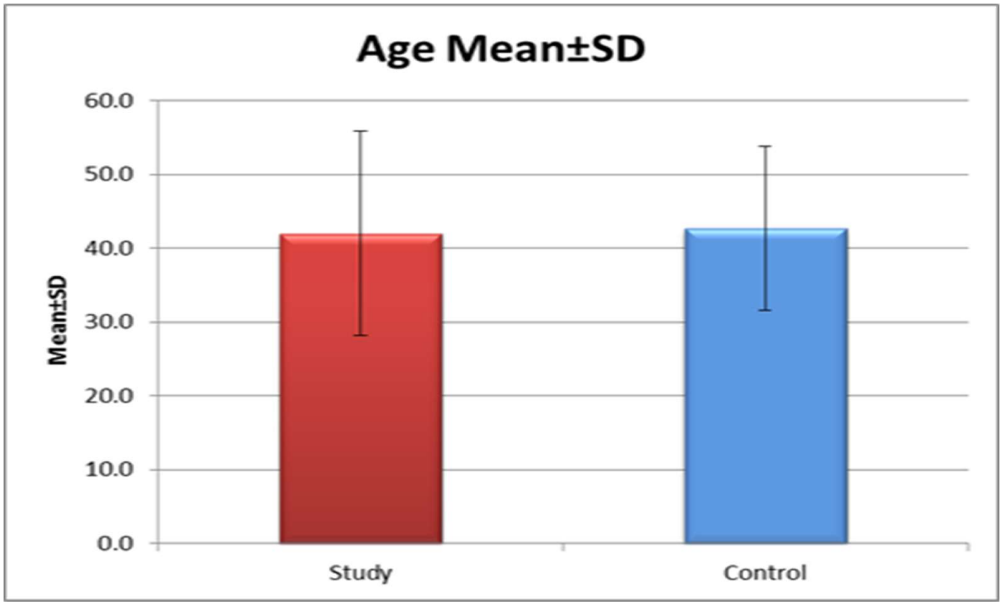
Table (1) - shows the frequency range of eye closure assessment based on grades for each eye care group, various follow-up days, and examination. On the first day of the follow-up, no one in the study group experienced ocular closure severity grade II (both right and left eyes), although four people in the control group did. Gradually worsening grades were given in both groups on various follow-up days.

Table (2) - Shows the frequency range of OSDs for each eye care group, as well as different days of follow-up and inspection. In neither group did OSDs progress on the first day of the follow-up. Results showed that the most of complained patients in the study group had cloudy corneas in the seventh day, while the most of complained patients in the control group had a mixed pattern of abnormalities in the cornea from the third ,fifth and the seventh day, including cloudy corneas, corneal abrasions, corneal ulcers, and keratopathy. There was a significant statistical variation as well between the study and control groups, according to Rt eye in the third, fifth, and seventh days (P right eye =0.010& P=0.011& P=0001& P= 0.002&P=0.004), respectively, and connected to Lt eye in the seventh day (P left eye= 0.015).

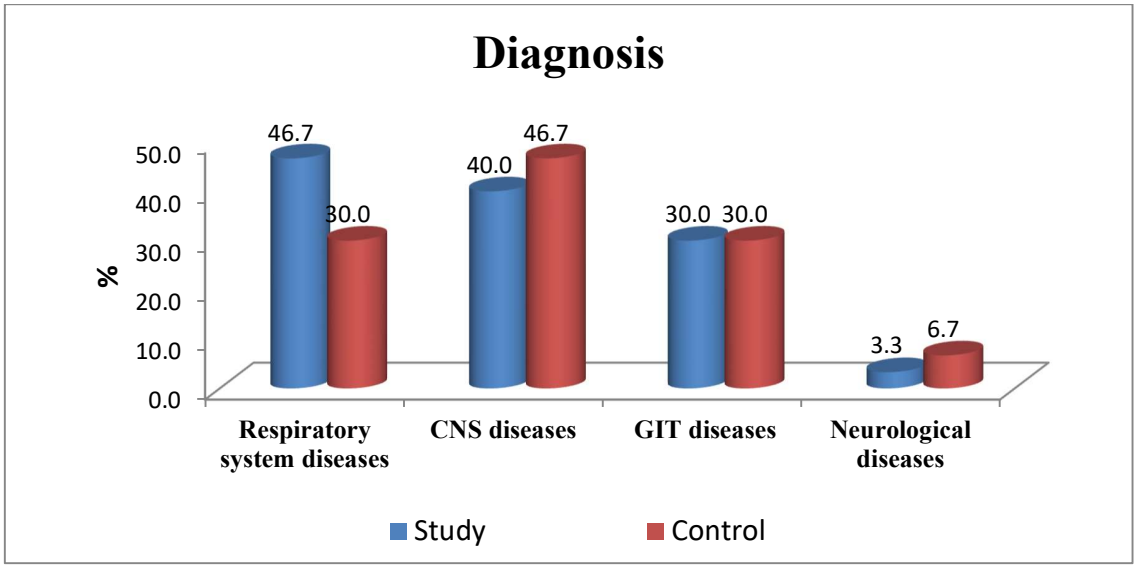
Table (3) - Results showed that the bulk of patients who complained in the study group had conjunctival discharge in both eyes from the third to the seventh day, while most of the patients who complained in the control group had a variety of conjunctival abnormalities, including chemosis, discharge, ciliary injection, and conjunctiva injection in both eyes from the third to the seventh day. Ocular surface disorders development was less pronounced in the study group than in the control group.


Sex
80.0
70.0
80.0
60.0
40.0
20.0
0.0
%
30.0
20.0
Male
Female
Study
Control

(A)


Age Mean±SD
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Mean±SD
Study
Control

(B)



(C)

Figure (1) A, B, C: Distribution of demographic data and clinical data for both groups (n=60)

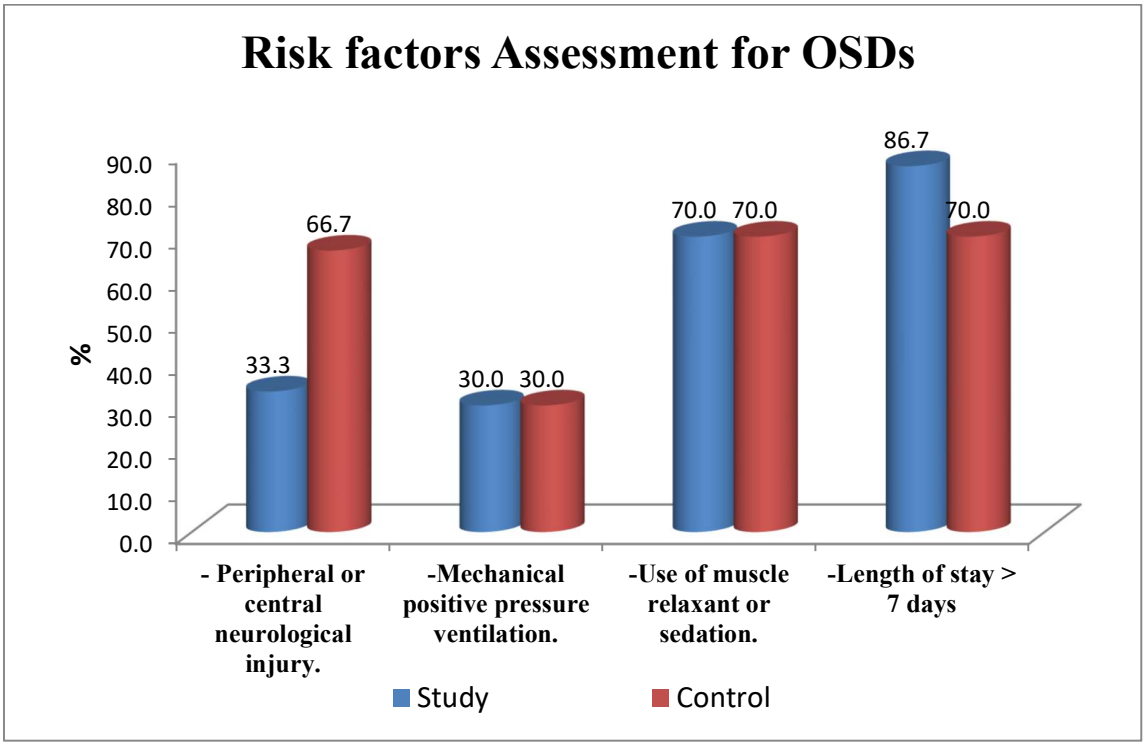


Figure (2):- Distribution of risk factors assessment for OSDs for both groups =60)

Table (1): - Distribution of eye closure assessment sheet for both groups (n=60)

Eye Closure Grade (ECG)	Right eye closure					Left eye closure				
	Study(n=30)		Control(n=30)		P. value	Study(n=30)		Control(n=30)		P. value
	No	%	No	%		No	%	No	%	
1st day										
Grade 0	29	96.7	22	73.3	0.034*	28	93.3	23	76.7	0.096
Grade I	1	3.3	4	13.3		2	6.7	3	10.0	
Grade II	0	0.0	4	13.3		0	0.0	4	13.3	
3rd day										
Grade 0	7	23.3	0	0.0	0.002**	6	20.0	3	10.0	0.097
Grade I	22	73.3	22	73.3		23	76.7	21	70.0	
Grade II	1	3.3	8	26.7		1	3.3	6	20.0	
5th day										
Grade 0	1	3.3	0	0.0	0.032*	0	0.0	0	0.0	0.024*
Grade I	24	80.0	16	53.3		25	83.3	17	56.7	
Grade II	5	16.7	14	46.7		5	16.7	13	43.3	
7th day										
Grade 0	2	6.7	0	0.0	0.317	1	3.3	0	0.0	0.556
Grade I	5	16.7	4	13.3		6	20.0	5	16.7	
Grade II	23	76.7	26	86.7		23	76.7	25	83.3	

Chi square test for qualitative data ***Significant level at P value < 0.05**

Table (2):- Distribution of eye examination (Cornea abnormality) for both groups

Cornea (abnormality)	Right cornea eye					Left cornea eye				
	Study		Control		P. value	Study		Control		P. value
	No	%	No	%		No	%	No	%	
1st day	N=3		N= 7			N=3		N=9		
Cloudy: iris may be difficult to see	3	100.0	7	100.0	-	3	100.0	8	88.9	0.546
Mixed	0	0.0	0	0.0		0	0.0	1	11.1	
3rd day	N= 4		N=17			N=6		N=15		
Cloudy: iris may be difficult to see	4	100.0	5	29.4	0.010*	2	33.3	3	20.0	0.517
Mixed	0	0.0	12	70.6		4	66.7	12	80.0	
5th day	N=4		N=22			N=4		N=25		
Cloudy: iris may be difficult to see	3	75.0	1	4.5	0.002**	3	75.0	6	24.0	0.122
Corneal abrasion	0	0.0	1	4.5		0	0.0	1	4.0	
Mixed	1	25.0	20	90.9		1	25.0	18	72.0	
7th day	N= 4		N=27			N=3		N=24		
Cloudy: iris may be difficult to see	4	100.0	5	18.5	0.004**	3	100.0	5	20.0	0.015*
Corneal abrasion	0	0.0	1	3.7		0	0.0	1	4.0	
Mixed	0	0.0	21	77.8		0	0.0	19	76.0	

Chi square test for qualitative data ***Significant level at P value < 0.05**

Table (3):- Distribution of eye examination (Conjunctiva abnormality) for both groups

(Conjunctiva abnormality)	Right conjunctiva					Left conjunctiva				
	Study		Control		P. value	Study		Control		P. value
	No	%	No	%		No	%	No	%	
1st day	N=2		N=6			N=4		N=8		
Chemosis	0	0.0	1	16.7	0.641	0	0.0	1	12.5	0.585
Discharge	2	100.0	4	66.7		2	50.0	5	62.5	
Mixed	0	0.0	1	16.7		2	50.0	2	25.0	
3rd day	N=6		N=13			N=3		N=14		
Chemosis	0	0.0	1	7.7	0.174	0	0.0	2	14.3	0.129
Discharge	4	66.7	3	23.1		0	0.0	7	50.0	
Mixed	2	33.3	9	69.2		3	100.0	5	35.7	
5th day	N=6		N=14			N=5		N=20		
Chemosis	1	16.7	0	0.0	0.091	0	0.0	0	0.0	0.405
Discharge	3	50.0	3	21.4		1	20.0	8	40.0	
Mixed	2	33.3	11	78.6		4	80.0	12	60.0	
7th day	N=5		N=24			N=4		N=28		
Chemosis	0	0.0	1	4.2	0.006	0	0.0	1	4.2	0.001**
Discharge	4	80.0	3	12.5		4	100.0	5	18.5	
Mixed	1	20.0	20	83.3		0	0.0	22	81.5	

Chi square test for qualitative data *Significant level at P value < 0.05

Discussion

The study observed a gap in existing practice, which was confirmed by bedside audits. The study's goal was to implement and evaluate eye care intervention to help patients who were at risk for eye disorders. **In regard to demographic data,** the bulk of patients in this study were male, and nearly half of both the study and control groups were over forty years old, with no statistically significant difference between the two groups. **This could be due to** the small size of the study sample. This was in agreement with **Babamohamadi et al (2018)** [13] who investigated the impact of vitamin A ointment with polyethylene cover and discovered that there was no significant difference in demographic data between two groups ($p > 0.05$) **(Li and Zhou 2022)** [14]**.**

Regarding risk factors assessment: using of mechanical ventilation, including oxygen masks, the prone position, PEEP and CPAP stand for positive end-expiratory pressure and continuous positive airway pressure, respectively. Patients who take sedatives, tranquillizers, or neuromuscular blockers are also more likely to experience problems with their eyes **(**At**iaa etal, 2015) [15].**

The finding of current study revealed that Patients on mechanical ventilation who use sedatives or neuromuscular blocking drugs are more likely to have a corneal problem due to weakened defenses. The study's findings supported the link between mechanical ventilation duration and the development of eye problems **(Alansari etal, 2015)[16].**

The current study found that all patients on mechanical ventilation with positive end-expiratory pressure (PEEP) greater than 5 mmH2O have an increased incidence of ocular surface diseases. This is due to the longer exposure to factors that increase the risk of eye problems, include respiratory infections, ventilator-associated pneumonia, and comatose patients with serious diseases (VAP).

This is in line with **Ebadi.et al; (2017)** [17] who discovered that mechanically ventilated patients with PEEP greater than 5 mmH2O are more likely to develop "ventilatory eye," conjunctival edema, and chemosis, which are caused by reduced venous drainage. Patients who require frequent endotracheal suctioning have an increased risk of infection, particularly if an improper technique is used.

The eyelid taping group had the highest rate of OSD. In patients with extreme levels of chemosis, it might be challenging to shut the eyelid with tape because doing so could possibly result in conjunctival abrasion and rupture According to **Ahmadinejad.et al (2012)**[18] there was no discernible difference between the cover and ointment methods. As a result, the new adult eye care package was approved for use after a review of the prior literature that used various methods for eye care and suggested that eyelids should remain closed despite a decreased level of consciousness, as well as the simple eye ointment and polyethylene cover as acceptable eye care methods in ICU .

Finally, although two groups of patients in this study shared the same risk factors**,** which significantly decreased the incidence of OSDs in which the most of complained patients in the control group had a mixed pattern of abnormalities in the cornea from the second to the seventh day, including cloudy corneas, corneal abrasions, corneal ulcers, and keratopathy as well as in the conjunctiva

As a result, eye health evaluation should be a routine part of Intensive Care Unit patient physical assessment procedures. To help prevent eye complications and maintain patients' quality of life in ICU settings, meticulous care and increased awareness of eye complications and risk factors are required. During an eye health examination, the following tests should be performed: evaluation of other eye structures, evaluation of the white of the eye, and evaluation of eye protective mechanisms **(Ahmadinejad.et al (2020)** [19].

Conclusion

The implementation of an evidence based eye care intervention reduced the incidence of ocular surface problems among mechanically ventilated patients because each component of the bundle was created with the backing of high-quality data.

Recommendation

1. Regular and necessary eye care can lower the risk of eye complications and infection.
2. Using emerging clinical interventions to prevent and treat dry eye disease in mechanically ventilated patients.
3. Assistive product requirements for the vision interventions should be available.

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