

**Perioperative Corneal Abrasion: An Exploration of Certified Registered Nurse
Anesthetists' Preferences for Corneal Abrasion Prevention**

Justin Grady, BSN, SRNA

Maura McAuliffe, PhD, CRNA, FAAN

Nurse Anesthesia Program

College of Nursing, East Carolina University

Submitted in partial fulfillment of the
requirements for the degree of Doctor of Nursing Practice

Finalized November 23, 2022

Abstract

Corneal abrasions are the most common eye injury occurring during the perioperative period and anesthesia providers are responsible for maintaining patient safety during this time. This quality improvement project was performed to assess CRNAs' preferences and practices regarding perioperative eye care and corneal abrasion prevention and perceptions of a newly developed corneal abrasion quick reference guide. A single plan-do-study-act cycle was utilized. The guide was provided to participants in both electronic and physical format and electronically delivered and Qualtrics surveys were employed to gather preferences and perceptions of the CRNAs prior to and after two weeks of guide use. Despite no standardized protocols for eye care at this facility, only one of the four participating CRNAs reporting ever having taken care of a patient diagnosed with a corneal abrasion and the majority already adhered to suggestions/guidelines described in current literature. Though the general trend was a slight increase in overall confidence level, it was difficult to discern changes due to only three CRNAs out of four responding to the post-intervention survey. Two thirds of post-survey participants reported they did not find the quick-reference guide useful and would be unlikely to use it in the future. Results of this quality improvement project, though limited, reinforce that eye protective measures are performed but are provider dependent with risk of injury an ongoing concern. Future efforts should include increased opportunities for participants to ask questions and provide feedback regarding prevention methods, a larger sample size, and longer period of exposure to the intervention.

Keywords: corneal abrasions, perioperative, anesthesia

Table of Contents

Abstract	2
Section I: Introduction	5
Background.....	5
Organizational Needs Statement.....	7
Problem Statement.....	8
Purpose Statement.....	8
Section II: Evidence.....	9
Description of Search Strategies.....	9
Selected Literature Synthesis.....	10
Project Framework.....	13
Ethical Consideration and Protection of Human Subjects.....	14
Section III: Project Design.....	15
Project Setting.....	15
Project Population.....	15
Project Team.....	15
Methods and Measurement.....	16
Section IV: Results and Findings.....	19
Results.....	19
Data Presentation.....	19
Analysis.....	24
Section V: Implications.....	26
Financial and Nonfinancial Analysis.....	26

Implications of Project	26
Sustainability	28
Dissemination Plan	28
Section VI: Conclusion.....	29
Limitations.....	29
Recommendations for Future Implementation and/or Additional Study.....	29
References.....	31
Appendices (include as many as you need).....	34
Appendix A: Literature Concept Table & Search Strategy.....	34
Appendix B: Literature Search Log.....	35
Appendix C: Literature Matrix.....	37
Appendix D: College of Nursing and Facility IRB Approval Forms.....	42
Appendix E: Quick-Reference Guide.....	49
Appendix F: Emails to Participants.....	51
Appendix G: Participant Surveys.....	55

Section I. Introduction

Background

In the perioperative period, anesthesia providers are responsible for maintaining patients' homeostasis. This includes the mitigation of adverse events such as eye injuries from occurring while patients are anesthetized. Potential perioperative eye injuries include corneal abrasions, periorbital edema, excessive dryness, ptosis, ophthalmoplegia, ocular ecchymosis, tearing of the eyelid, conjunctivitis, scleral chemical burns, retinal detachment, and loss of vision (O'Driscoll & White, 2016; Papp et. al., 2019). Of the many eye injuries documented, however, corneal abrasions are the most common, accounting for 35% of all ocular injury malpractice claims (Malafa et. al., 2016; O'Driscoll & White, 2016; Papp et. al. 2019). If anesthesia providers use evidence-based guidelines and standardized protocols for perioperative eye care, the incidence of corneal abrasions and healthcare costs related to this complication could be reduced.

Corneal abrasions typically present as pain, tearing, blurry vision, and photophobia (Malafa et. al., 2016; Papp et. al. 2019). Many corneal abrasions are related to direct trauma from equipment such as stethoscopes, the operating table, face masks, and even the anesthesiologist's or nurse anesthetist's name badge (Malafa et. al., 2016). Inadequate closure and securing of the eyes during the induction period has also been identified as a cause of corneal abrasions. Although every patient undergoing surgical intervention has a risk of perioperative eye injuries, some are at much higher risk than others. Research suggests advanced age, positioning, general anesthesia, prolonged surgical procedures, operations on the head and neck, robotic surgeries, chronic dry eye, history of ocular surface injury, and Cogan-Guerry dystrophy are the major risk factors for corneal abrasions (Malafa et. al. 2016; O'Driscoll & White, 2016; Papp et. al., 2019).

These risk factors primarily stem from conditions that diminish the structural integrity of the eye and its natural protective mechanisms (Malafa et. al., 2016).

The interventions employed to prevent corneal abrasions vary depending on the anesthesia provider. Those more commonly employed include manual eyelid closure, taping eyelids, bio-occlusive dressings, and the application of various ophthalmic ointments and hydrogels (Malafa et. al. 2016; O'Driscoll & White, 2016; Papp et. al., 2019). According to both Papp et. al. (2019) and O'Driscoll and White (2016), application of bio-occlusive dressings, such as Tegaderm, are the most effective method of preventing corneal abrasions. Studies of anesthesia providers have demonstrated that educational interventions, especially those that standardize patient care (Papp et al., 2019) and make providers feel more involved and engaged (Malafa et al., 2016) lead to improved care delivery and lower occurrence of adverse events.

Perioperative ocular injuries account for nearly 2% of all anesthesia related malpractice claims and range from mild, irritating injuries to permanent ocular loss (O'Driscoll & White, 2016). Claims associated with ocular injuries are associated with 4% higher awards compared to other injury claims (Papp et. al., 2019). Despite these high costs and undesirable patient outcomes, no professional anesthesia organization has developed standardized protocols for the prevention of ocular injuries in the perioperative period and there are no prospective studies clearly demonstrating that one protocol is better at preventing corneal abrasions. Although healthcare professionals have reduced the incidence of corneal abrasions to 0.013% – 0.17%, there may be interventions that could reduce it further (Lichter et. al., 2015).

In summary, the provision of perioperative eye care is essential, and the consequences of suboptimal care lead to patient harm. Multiple risk factors should be considered to determine anesthesia providers' care for at-risk patients. Though many interventions exist to decrease the

prevalence of corneal abrasions, there is a gap in optimization of eye care in the context of standardized protocols. Although literature findings vary regarding what is most important in perioperative eye care, it is clear that ocular eye protection during the perioperative period is crucial in preventing corneal abrasions and the subsequent patient discomfort and morbidity associated with these preventable events.

Organizational Needs Statement

Corneal abrasions have been reported as the most common ocular injury as far back as 1965 and remain an issue in healthcare today (Morris et. al., 2018). Although perioperative guidelines are available in current literature (Malafa et. al., 2016), professional anesthesia organizations have not endorsed guidelines, position statements, or standards for corneal abrasion prevention. This has left prevention and treatment of corneal abrasions for individual provider or facility-wide decision.

A search of the partnering facility's policy database revealed no policy addressing specific eye care and prevention measures of corneal abrasions during the perioperative period. The project chair, M. McAuliffe (personal communication, August 31, 2021) confirmed there is no specific anesthesia policy for corneal abrasion mitigation procedures, and that while corneal abrasion prevention is performed regularly, it is based on provider preference and varies among anesthesia providers.

The American Association of Nurse Anesthesiology (AANA) provides many standards, guidelines, and position statements related to patient care in the perioperative period. Although the AANA has not promulgated a specific standard for corneal abrasion injury prevention, they have published standards for monitoring and positioning that broadly address corneal abrasion prevention. Standard VIII addresses proper body alignment and protective measures for pressure

points and nerve plexus, while Standard IX addresses the monitoring and evaluation of patients' condition appropriate for surgical procedure and anesthetic technique (AANA, 2019). Providing perioperative ocular protection addresses both standards.

Problem Statement

Perioperative corneal abrasions are the most common type of ocular injuries reported in non-ocular surgery with an incidence of 0.64 % (Papp et al., 2019). In the literature, evidence-based guidelines and standardized protocols by anesthesia providers have shown potential in reducing corneal abrasions. Like most institutions, the partnering facility does not recognize a standardized approach to eye care during surgical anesthesia.

Purpose Statement

The purpose of this quality improvement project was to assess CRNAs' preferences and practices regarding perioperative eye care and corneal abrasion prevention and their perceptions of a corneal abrasion quick reference guide as a useful tool to prevent corneal abrasions.

Section II. Evidence

Description of Search Strategies

The PICOTS question used to guide the literature search was: How do CRNAs perceive a quick reference guide designed to decrease the incidence of corneal abrasions in the operating room? The main concepts identified for use in searching the literature were corneal abrasions, perioperative, and anesthesia. Keywords for each were then identified to maximize the search results. The keywords for corneal abrasion were corneal abrasions, corneal injuries, ocular injuries, eye care, and ocular care. The keywords for perioperative were surgery, surgical, operative, perioperative, and intraoperative. The keywords for anesthesia were anesthesia, CRNA, and certified registered nurse anesthetist.

Searches for pertinent literature were performed using PubMed, CINAHL, and Google Scholar. The search strategy used for PubMed was anesthesia AND (corneal injuries) AND surgery. Utilizing this search string, the MeSH terms identified through PubMed automatic mapping included corneal injuries, surgical procedures, operative, general surgery, and anesthesia. With this search, 54 articles were found and six were kept for full-text review after consideration of title and abstract information.

The subject terms for CINAHL were corneal injuries, contusions and abrasions, perioperative nursing, perioperative medicine, anesthesia, education, nurse anesthesia, anesthesia, and general anesthesia recovery. The search strategy used for CINAHL was ((MH "Contusions and Abrasions") OR (MH "Corneal Injuries") OR "corneal abrasion") AND ((MH "Risk for Perioperative Positioning Injury (NANDA)") OR (MH "Perioperative Positioning Injury (Saba CCC)") OR (MH "Perioperative Injury Risk (Saba CCC)") OR (MH "Perioperative Nursing") OR (MH "Perioperative Medicine") OR (MH "Perioperative Injury Care (Saba

CCC)") OR (MH "Perioperative Care (Iowa NIC)") OR "Perioperative") AND ((MH "Education, Nurse Anesthesia") OR (MH "Anesthesia Recovery") OR (MH "Anesthesia, General")). Of the four articles identified, two were kept for full-text review after title and abstract assessment.

The search strategy for Google Scholar was ((perioperative) OR (intraoperative)) AND ((eye care) OR (ocular care)) AND (Corneal abrasion). The first 10 pages of results were reviewed, with nine kept for full text review after title and abstract assessment.

Searches were limited to articles published in English and within the last 10 years (2011-2021). Articles were included that pertained to incidence, prevalence, risk factors, prevention, intervention, physiology, pathophysiology, or interventions related to corneal abrasion for non-ocular surgeries during the perioperative period. Any articles related to ocular surgery were excluded. See Appendix A for the concept chart and Appendix B for the literature search log.

Upon full-text review, one systematic review (Level V), four quality improvement projects (Level VI), and two expert opinion papers (Level VII) were identified as pertinent to this project (Melnik & Fineout-Overholt, 2019). Refer to Appendix C for the literature matrix.

Selected Literature Synthesis

Although the literature varies on effective preventative measures for corneal abrasions, seven of the eight articles selected for inclusion in this synthesis designated taping of the eyelids as the most crucial and effective measure (Gonzalez-Birr, 2020; Kaye et. al., 2019; Malafa et. al., 2016; O'Driscoll & White, 2016; Papp et. al., 2019; Segal et. al., 2014; Vetter et. al., 2012). Kaye et. al., Malafa et. al., and O'Driscoll and White further stress the importance of taping the eyelids directly after induction and before airway manipulation to decrease the risk of mechanical injury during the intubation period. The type of tape is also important because permeability to fluids varies across products and could potentially lead to chemical eye injuries

(Kaye et. al., 2019). Bio-occlusive dressings have been demonstrated to be the most effective at protecting the eye from chemical and mechanical injuries while also minimizing tear film evaporation (Kaye et. al., 2019; Malafa et. al., 2016; O'Driscoll et. al., 2016; Papp et. al., 2019).

Use of eye lubricants is another measure that has been demonstrated in some studies to be efficacious in the prevention of corneal abrasions (Kaye et. al., 2019; Malafa et. al., 2016; O'Driscoll & White, 2016; Papp et. al., 2019; Segal et. al., 2014; Vetter et. al., 2012). Kaye et. al., Malafa et. al., and O'Driscoll and White all emphasize that when used, lubricants should be free of preservatives and petroleum to decrease the incidence of ocular irritation and flammability. Additionally, halothane and isoflurane are highly soluble in petroleum lubricants which can result in chemical injury to the eye (Malafa et. al., 2016). According to Malafa et al., there is no advantage to combining lid taping and lubrication and it can prevent tape adhesion.

Educational prevention models were utilized and studied by Gonzalez-Birr (2020), O'Driscoll and White (2016), and Papp et. al. (2019). A quality improvement project performed by Gonzalez-Birr focused on correcting provider prevention methods rather than directly measuring corneal abrasion incidence. The project, which involved administration of a pre-test followed by an educational in-service and then a post-test, showed no statistically significant impact on providers' preventative practice. However, of the 40 anesthesia providers participating in the project, 80% felt that further educational interventions could impact change in their perioperative corneal abrasion prevention methods. Conversely, an expert opinion article written by O'Driscoll and White cited a reduction in corneal injuries from 0.15% to 0.079% through an educational program that consisted of a lecture on the causes and prevention of corneal injuries with emphasis on taping the eyes immediately after induction but before airway manipulation.

Furthermore, a systematic review performed by Papp et. al. also demonstrated a statistically significant decrease in the rate of corneal abrasions with educational intervention.

Despite preventative measures, corneal abrasions still occur in the perioperative period. All literature reviewed described the treatment of corneal abrasions with some combination of topical antibiotics, lubricants, and oral analgesics (Kaye et. al., 2019; Lichter et. al., 2015; Malafa et. al., 2016; Papp et. al., 2019; Segal et. al., 2014). Although eye patches have been used in the past to treat corneal abrasions, they are no longer recommended as studies suggest no benefit and delayed healing is associated with their use (Lichter et. al., 2015; Malafa et. al., 2016). Treatment with steroids is contraindicated for patients with corneal abrasions because they delay healing and increase incidence of infection (Kaye et. al., 2019; Malafa et. al., 2016). Local anesthetics were previously believed to delay healing in corneal abrasions, however, both Kay et. al. and Malafa et. al. suggest that local anesthetics relieve pain, improve patient satisfaction, and do not delay healing of corneal abrasions.

Two quality improvement projects utilizing standardized protocol interventions demonstrated statistically significant decreases in the occurrence and severity of corneal abrasions. Vetter et. al. (2012) implemented a prevention protocol in 163,195 patients undergoing general anesthesia that consisted of lubricating the eyes and then applying two bio-occlusive dressings large enough to cover the entire eyelid and surrounding area immediately after securing the airway. The project demonstrated an overall decrease in the incidence of corneal abrasions from 1.20/1000 general anesthesia cases to 0.09/1000 general anesthesia cases after implementation of the standardized protocol. Lichter et. al. (2015) implemented an anesthesiology-led treatment protocol for corneal abrasions that consisted of artificial tears and 0.5% erythromycin ophthalmic ointment or alternative topical antibiotic if allergic to

erythromycin. Throughout the study period, there were 91,064 surgical cases with 118 reported cases of corneal abrasions. 110 of the 118 reported cases of corneal abrasions was treated solely by anesthesia providers. This project showed a 93% success rate of independent anesthesiology treatment of corneal abrasions with 100% resolution of symptoms within 24 hours. The faster resolution of corneal abrasion symptoms decreased patient discomfort and increased overall patient satisfaction.

In conclusion, evidence within current literature shows standardized protocols utilizing evidence-based interventions for the prevention and treatment of corneal abrasions can reduce its incidence and impact on patient comfort and satisfaction.

Project Framework

The plan-do-study-act (PDSA) cycle was utilized to guide this project. The *plan* phase consists of identifying a problem, formulating questions and predictions, and then developing a plan (Taylor et. al., 2014). The *do* phase consists of executing the plan while documenting problems and unexpected observations. The *study* phase consists of data analysis and comparison of data to predictions. The *act* phase consists of utilizing the data to identify adaptations that need to be made for the next cycle. The cycle is repeated until sufficient outcomes allow for adoption of the intervention.

According to Taylor et. al. (2014), quality improvement in healthcare settings is complex due to unpredictable social system changes. To be effective, a quality improvement framework must be multi-faceted and adaptive to counter unforeseen obstacles and unintended effects. The PDSA cycle is one method that provides both an adaptive and multi-faceted approach to quality improvement. Through the implementation of the cycles, unexpected observations and unintended outcomes can be identified and plans can be adjusted accordingly. Overall, PDSA

cycles have demonstrated significant improvements in care and patient outcomes, making it a valuable tool for this project.

Ethical Considerations and Protection of Human Subjects

No patient data or personal information was collected during this project. The benefits and risks applied equitably to all participants and involved no risk of harm beyond what is normally encountered in their daily work patterns, other than some potential for added stress and time pressures associated with learning and adding in additional activities to the workflow. All guidance provided was within the current scope of practice of all participants.

An approval process was completed through the College of Nursing at East Carolina University (ECU) in conjunction with the ECU University and Medical Center Institutional Research Board (UMCIRB) to evaluate the need for full IRB approval. As the project met criteria for quality improvement, full review was not required. Facility approval was also completed through the research office of the partnering facility in conjunction with the ECU UMCIRB. Additionally, local facility approval to collect data was obtained from a site contact person whose signature was required on the facility approval form. Collaborative Institutional Training Initiative (CITI) modules were completed by the investigators prior to the initiation of this project (www.citiprogram.org). Refer to Appendix D for the approval verification forms.

Section III. Project Design

Project Setting

This quality improvement project was completed in operating rooms within a small, rural hospital in Eastern North Carolina. The hospital has approximately 120 inpatient beds and a shared inpatient and ambulatory surgical suite with fewer than 10 operating rooms, including one for performing caesarean sections and one reserved for endoscopic procedures (Department for Health and Human Services, 2020). Facilitators for the project were anesthesia department's willingness to allow the project and on-site anesthesia personnel assisting with information dissemination and collection. Potential barriers included small sample size due to the size of the facility, its small number of operating rooms, and its limited number of surgical cases.

Project Population

The project population consisted of CRNAs employed at the partnering facility. The CRNAs work in the operating room in coordination with nursing and surgical staff to perform surgical procedures. The CRNAs are responsible for airway management, anesthetic delivery and maintenance, hemodynamic management, positioning, and patient safety. A facilitator to the project were positive CRNA willingness to participate in the study. A barrier to the project were CRNA time constraints.

Project Team

The team implementing this project consisted of a student registered nurse anesthetist (SRNA) team lead who performed a literature review and collaborated with three other SRNA students to formulate the educational handout tool and pre- and post-intervention Qualtrics survey questions utilized in this project. The project lead was also responsible for data collection, analysis, and dissemination. A project chair, who is also the program director, finalized and

approved the educational handout tool and pre- post-intervention Qualtrics survey questions. A CRNA faculty member coordinated site location and CRNA participants and a site contact person facilitated contact with the CRNA project participants. The course director provided editorial feedback and facilitated meetings between SRNAs and project chairs.

Methods and Measurement

The goal of this quality improvement project was to assess CRNAs' preferences and practices regarding eye care and corneal abrasion prevention and whether they perceived the corneal abrasion quick reference guide as a useful tool for their practice to prevent perioperative corneal abrasions. A quick reference guide was formulated by the project team using current literature on corneal abrasion prevention and treatment. The guide was delivered to participants both electronically, through email, and physically, through a laminated guide. The perceptions of the CRNAs concerning the reference guide were assessed using electronically delivered pre-intervention and post-intervention Qualtrics surveys.

During the *plan* portion of the PDSA cycle, the project team identified and defined the problem that is corneal abrasions. A literature review was then performed to determine current best practice for corneal abrasion prevention and treatment. The team then reviewed current guidelines and practices being utilized at the partnering facility and compared them to recommendations present in the literature. Upon finding beneficial interventions described in the literature, the team set out to develop a quick, easy way to disseminate this information to providers at the facility. To do this, data was synthesized from the literature review to formulate a quick reference guide containing this information in an easy to read, easy to access approach including a flow chart for prevention and treatment. Survey questions were then developed to ascertain providers' perceived usefulness of this formulated tool and their potential utilization of

the tool in their current and future practice. The pre- and post-intervention surveys contained Likert type, yes or no, and open response questions allowing for collection of nominal and ordinal data for analysis.

The *do* portion of the PDSA cycle began with project approval through both the unit representative and the organization. A form was submitted that included the name of the project lead along with the project title and a brief description of what the project entailed. Once the project was deemed quality improvement, approval by the facility was achieved. The unit representative was then contacted through email, facilitated by the CRNA clinical faculty member with the same information provided to the facility. The quick reference guide and a description of dissemination through email to all participants was also included in the information provided to the unit representative. Upon approval, the unit representative recruited willing participants and the project lead was notified of those individuals. The pre-intervention survey was then sent to these individuals through email, and they were asked to complete it within 24 hours if possible. Upon completion of the pre-intervention survey, the quick reference guide was then distributed to participants through email with a description of the guide and how to use it. A hard copy of the guide was also provided to participants. A PowerPoint presentation was also electronically provided with a voiceover to extensively go over the quick-reference guide. Participants were asked to utilize the quick reference guide for two weeks and to fill out the post intervention survey at the end of that period. Refer to Appendix E for quick-reference guide, Appendix F for the emails to the participants, and Appendix G for pre- and post-intervention surveys.

Implementation of the *study* portion of the PDSA cycle consisted of analysis of the data obtained through the pre- and post-intervention surveys. The results of the surveys were

available immediately upon completion by participants. The data gathered from the pre- and post-intervention surveys was compared and used to evaluate provider current practice, perception of the quick-reference guide, use during the two-week period, and potential future use of the quick-reference guide in their practice.

The *act* phase included using findings to make recommendations for modification to the guidelines and future PDSA cycles associated with this topic. The act phase also included the synthesizing of results into a poster that was presented to CRNA faculty, students, and other invited guests.

Section IV. Results and Findings

Results

Data collection was initially planned for a two-week period but was extended to three weeks to allow extra time for participant survey responses. The first email, which was sent to four participants, included the quick-reference guide, the PowerPoint presentation, and the pre-intervention survey link using Qualtrics. Pre-intervention survey responses were received over the course of the next 3 days with a total of two participant responses. A reminder email was sent out in the middle of the first week to remind potential participants about the pre-intervention survey, which resulted in another two participant responses for a total of four. After the two weeks of intervention utilization, an email was sent to the four participants with the post-intervention survey link utilizing Qualtrics resulting in a total of two responses. Another follow-up email was sent to the four participants one week later resulting in one additional post-intervention survey response totaling three responses for the post-intervention survey.

Following data collection, the results from Qualtrics were exported into Microsoft Excel. Excel was then used to analyze and produce graphical representations of the data.

Data Presentation

The pre-intervention survey was designed to measure CRNA perceptions regarding corneal abrasions and current prevention practices. Reported prior experience with patients sustaining corneal abrasions was minimal, with three of the four participants never having been involved in the care of a patient diagnosed with a corneal abrasion. The single CRNA who reported being involved in the care of a patient who had a corneal abrasion reported “patient rubbing eyes upon emergence/recovery” as the cause of the injury.

The current prevention practices reported by CRNAs in the pre-intervention survey showed three of the participants routinely utilize paper tape and clear tape while one CRNA utilized eye goggles for standard induction of general anesthesia. For high-risk cases, three of the CRNAs reported using eye goggles/shield, two reported using clear tape and paper tape, and one reported using tape/Tegaderm combined with eye lubricant. An additional prevention measure reported by one CRNA was tucking their badge into their scrubs before induction of general anesthesia. All four CRNAs reported taping the patients' eyes prior to securing the airway. One CRNA reported they assessed their patients' eyes during surgery every 15 minutes, while the other three reported doing so only during position changes.

When asked about their perceptions of patients at high-risk for corneal abrasions, half of the CRNAs reported being *highly confident* in their ability to identify patients at high-risk for corneal abrasions while the other half reported being *fairly confident*, as represented in **Figure 1**. The CRNAs identified dental procedures, exophthalmos, cases requiring the prone position, and cases requiring any position where direct visualization of the eyes is restricted as high-risk. One CRNA reported "all" surgical procedures as high-risk for corneal abrasions. When asked to rate their confidence in their ability to take appropriate measures to prevent corneal abrasions, three CRNAs reported they were *highly confident*, while one CRNA responding they were *fairly confident*, as reflected in **Figure 2**. Finally, when asked to rate confidence in their ability to assess, diagnose, and treat corneal abrasions, half reported being *highly confident* and half reported being *fairly confident* as represented in **Figure 3**.

Figure 1

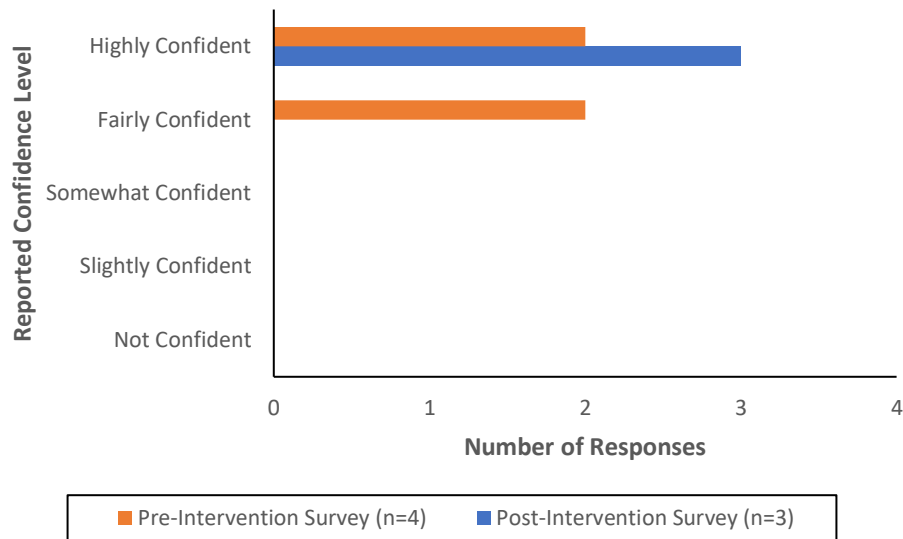
CRNA Confidence in Their Ability to Identify Patients at High Risk for Corneal Abrasions

Figure 2

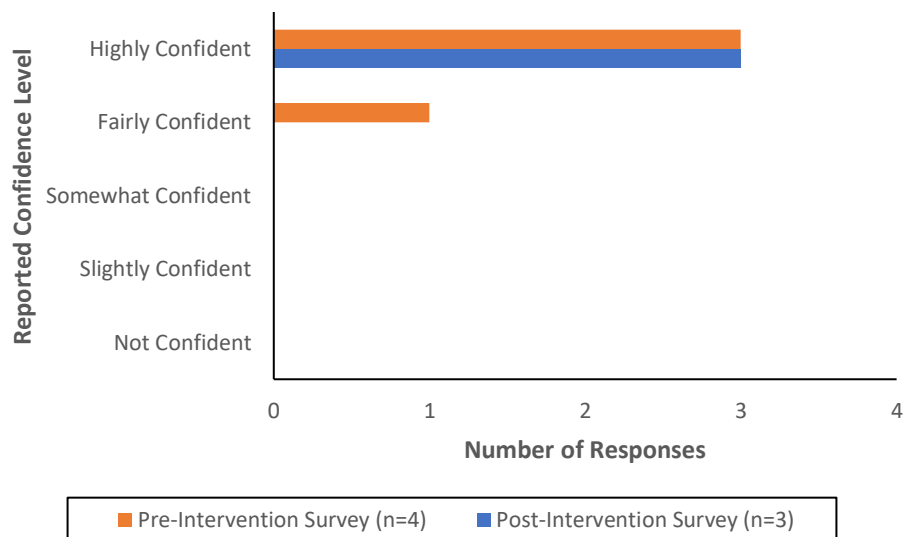
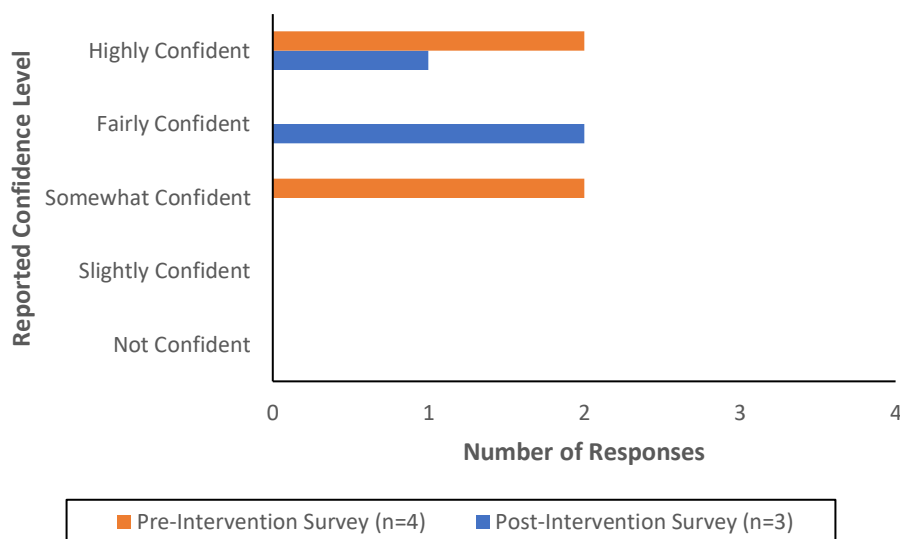
CRNA Confidence in Their Ability to Take Appropriate Measures to Prevent Corneal Abrasions

Figure 3

CRNA Confidence in Their Ability to Assess, Diagnose, and Treat Corneal Abrasions



The post-intervention survey was designed to discern CRNAs' corneal abrasion exposure, exposure to high-risk patients, and any potential changes to their practice after utilizing the quick-reference guide. Perception of the quick-reference guide, use during the two-week period, and potential future use were also assessed. Finally, CRNAs' confidence in their ability to identify patients at high-risk for corneal abrasions; ability to take appropriate measure to prevent corneal abrasions; and ability to assess, diagnose, and treat corneal abrasions was assessed for comparison with pre-intervention responses.

During the two-week implementation period, no CRNAs reported having been involved in any surgical cases where a corneal abrasion occurred. All three CRNAs identified 1-5 patients as being high-risk for corneal abrasions during the two-week period.

After utilizing the quick-reference guide, two of the CRNAs reported that they *agreed* their awareness for the potential of perioperative corneal abrasion increased, however, no

CRNAs reported they had initiated any changes in their practice. Two of the CRNAs perceived the handout as not useful while one CRNA said it was useful because it “reinforces common practice.” When asked if an Epic shortcut would allow for more streamlined documentation of eye care strategies, two CRNAs said they would not use it while one said they would.

Following intervention with the quick-reference guide, all CRNAs who responded to the post-intervention survey reported being *highly confident* in their ability to identify patients at high risk for corneal abrasions and their ability to take appropriate measures to prevent them. CRNA confidence in their ability to assess, diagnose, and treat corneal abrasions was not quite as absolute, with two CRNAs reporting being *fairly confident* and one CRNA being *highly confident* as graphically represented in Figure 3.

CRNAs’ reported an already high confidence level in identifying patients at high risk for corneal abrasions. Prior to the intervention two CRNAs reported being *fairly confident* and two CRNAs being *highly confident*. After implementation of the intervention, all three CRNAs reported high confidence. Refer to Figure 1 for graphical representation of CRNA responses.

Prior to implementation of the intervention the CNRAs’ reported a high level of confidence in taking appropriate measures to prevent corneal abrasions. One CRNA reported being only *fairly confident*. After implementation of the intervention, all responding CRNAs reported being *highly confident*. Refer to Figure 2 for graphical representation of CRNA responses.

Prior to implementation of the intervention the CNRAs’ reported a variety of confidence levels in their ability to assess, diagnose, and treat corneal abrasions. Half of the CRNAs felt *somewhat confident* while the other half felt *highly confident*. Post-intervention, two CRNAs felt

fairly confident and one CRNA felt *highly confident*. Refer to Figure 3 for graphical representation of CRNA responses.

Analysis

Although there is no current standardized protocol at the partnering facility for corneal abrasion prevention, analysis of the survey results revealed that the majority of CRNAs adhere to suggestions/guidelines described in current literature as evidenced by the participating CRNAs utilizing tape on patients' eyes before induction of general anesthesia. Additionally, many of the CRNAs use goggles/eye shields for cases they consider to be high risk. These common practices could account for their low incidence of patients diagnosed with corneal abrasions.

Upon reviewing and comparing pre- and post-survey responses, it was difficult to discern if there were changes in provider confidence levels in identification of high-risk patients or in prevention, assessment, diagnosis, and treatment of corneal abrasions due to only three CRNAs out of the four responding to the post-intervention survey. The general trend was a slight increase in reported overall confidence level. When asked about identifying high-risk patients and their ability to implement measures to prevent corneal abrasions, the responses shifted from a few CRNAs reporting *fairly confident* to all CRNAs reporting *highly confident*. When asked about their ability to assess, diagnose, and treat corneal abrasions, two CRNAs reported *somewhat confident* preintervention and all CRNAs reported being either *fairly confident* or *highly confident* postintervention. This data suggests that the intervention had some success in improving CRNA comfort levels regarding corneal abrasions. The lower confidence level in assessing, diagnosing, and treating corneal abrasions could be attributed to successful prevention methods that have resulted in such limited exposure to corneal abrasions that CRNAs have less confidence in their ability due to lack of experience.

Although the data suggested the quick-reference guide improved CRNA comfort levels, two thirds of the CRNAs said they did not find the quick-reference guide useful and none of the CRNAs reported that it changed their current practice. Though one CRNA did find the intervention useful because it “reinforces common practice.” The CRNA responses also did not demonstrate a high likelihood of using the quick-reference guide in the future. None of the participants listed any barriers to the use of the quick-reference guide at their facility.

Section V. Implications

Financial and Nonfinancial Analysis

The cost to implement this project was minimal. Primary costs consisted of printing fees and lamination which totaled \$54. However, this was with the purchase of a lamination machine due to the team not having access to one. Because the organization already has a lamination machine and printers, the cost of the implementation would be reduced to only the paper required to print the quick-reference guide and the sheets of laminate for each of their employees. Since the quick-reference guide is also available via employee cell phones and emails, it may not be necessary to provide them with a hard copy at all, reducing costs even further.

Employee time was not significantly impacted as the information was disseminated through a voice-over PowerPoint presentation so there was no need for an in-service. If the facility decided to perform an in-service utilizing the PowerPoint, then employee salary may have to be added to the total cost of the implementation. With the national average CRNA salary of \$96 per hour, the cost to the hospital would be \$96 per employee for a paid, 1-hour in-service.

Considering perioperative ocular injuries account for nearly 2% of all anesthesia related malpractice suits and exhibit 4% higher awards compared to other injury claims, the facility's financial burden of \$822 to implement this quality improvement initiative would be a good return on investment (O'Driscoll & White, 2016; Papp et. al., 2019).

Implications of Project

Review of the data from this QI project reinforces that eye protective measures are being performed on a regular basis but are provider dependent. This is evidenced by the variety of answers provided by CRNAs on the pre- and post-intervention surveys regarding the methods they use to prevent corneal abrasions.

While there are not standardized protocols for eye care at this facility, the incidence of corneal abrasions is low and only one of the four CRNAs had ever taken care of a patient diagnosed with a corneal abrasion. All measures currently being used by CRNAs at this facility are consistent with most recommendations described in current literature and are consistent with current standards for monitoring (Standard X) and proper protective measures for pressure points and nerve plexus (Standard VIII) set out by the AANA (2019). However, there were a few measures described in the literature not being utilized at the facility that could potentially augment prevention, if even only slightly.

Although the impact of this project seeks to decrease an already low incidence of corneal abrasions, for surgical patients being treated at this facility the further decrease would be valuable if only one additional corneal abrasion was prevented, saving a patient from going through the pain, discomfort, and stress associated with these injuries.

Impact on CRNA workload would be minimal if this initiative were implemented as CRNAs at the facility already utilize almost all of the recommended prevention methods. This means minimal changes would need to occur for the CRNAs to be utilizing all the tools available to them.

Finally, the impact on the facility has the potential to be financially beneficial because of the high costs associated with corneal abrasions and the low cost of reinforcing good eye protective strategies to their employees. The decrease in corneal abrasions would have a positive impact on the facility because improved patient outcomes are a main goal in all healthcare organizations.

Sustainability

Based on the financial analysis, the organization could implement a larger QI project utilizing this pilot without significant financial burden. If using solely electronic methods, many of the costs associated with this project would be eliminated and allow for long-term implementation potential. If the facility decided to perform an in-service on the quick-reference guide it might be associated with a nominal cost.

Dissemination Plan

Dissemination of the findings from this QI project included a poster presentation attended by CRNA department members, students, and project participants. The poster presentation was delivered in person to faculty and staff and was also available via Zoom to other SRNA students. This quality improvement project paper will also be posted in The Scholarship, East Carolina University's digital repository.

Section VI. Conclusion

Limitations

One major limitation for this quality improvement project was small sample size. Due to the number of employees at this rural hospital, there was limited data that could be reported. Another limitation is that the pre- and post-intervention surveys did not allow for as much comparison as was needed. Open ended comments were not included and may have provided additional insight when asking participants about the usefulness of the intervention and likelihood of future use. The limited time in which the project was performed also did not allow for an extended period of data collection.

Recommendations for Future Implementation and/or Additional Study

For future implementation of this project a larger population size is highly recommended. With the small sample size of this project, even missing a single post-intervention response made data analysis difficult.

Regarding the quick-reference guide utilized for this intervention, both an electronically accessible version and a hard copy version were provided to participants, however, there was a lot of information compacted into a small handout. A reduction in the verbiage used in the quick-reference guide could have yielded a slightly easier to digest form of dissemination of the information. Also, having a face-to-face meeting or vides call to explain the quick-reference guide may have been more beneficial than a voiceover PowerPoint presentation because it would have allowed the CRNAs the opportunity to ask questions about the guide and offer feedback about potential changes that need to be made.

Formatting the survey questions so that more of the pre- and post-intervention responses could be compared would allow for more effective assessment of change. Also, the addition of

open-ended questions to the pre- and post-intervention surveys would allow for an explanation from CRNAs as to why the intervention was not perceived as useful, which could provide vital missing information necessary to improve the intervention for further use.

Lastly, providing a longer time-period with extended exposure to the intervention may yield greater results in improving participant comfort level regarding corneal abrasion assessment, diagnosis, and treatment.

References

American Associate of Nurse Anesthesiology. (2019). *Standards for Nurse Anesthesia Practice*.

[https://www.aana.com/docs/default-source/practice-aana-com-web-documents-\(all\)/professional-practice-manual/standards-for-nurse-anesthesia-practice.pdf?sfvrsn=e00049b1_20](https://www.aana.com/docs/default-source/practice-aana-com-web-documents-(all)/professional-practice-manual/standards-for-nurse-anesthesia-practice.pdf?sfvrsn=e00049b1_20)

Department for Health and Human Services. (2020). *Hospitals: Licensed by the State of North*

Carolina. <https://info.ncdhhs.gov/dhsr/data/hllist.pdf>

Gonzalez-Birr, A. (2020). Perioperative Corneal Abrasion: An exploration of educational intervention effectiveness and impact on prevention practices (Publication No. 27837882) [Doctoral Dissertation, Georgetown University]. ProQuest Dissertations and Theses Publishing.

Kaye, A.D., Renschler, J.S., Cramer, K.D., Anyama, B.O., Anyama, E.C., Gayle, J.A., Armstead-Williams, C.M., Mosieri, C.N., Saus, J.A., & Cornett, E.M. (2019). Postoperative Management of Corneal Abrasions and Clinical Implications: A Comprehensive Review. *Current Pain and Headache Reports*, 23(7), Article 48. <https://doi.org/10.1007/s11916-019-0784-y>

Lichter, J. R., Marr, L. B., Schilling, D. E., Hudson, M. E., Boretsky, R. H., Barad, R. F., & Chelly, J. E. A. (2015). Department-of-anesthesiology-based management protocol for perioperative corneal abrasions. *Clinical Ophthalmology*, 9, 1689–1695. <https://doi.org/10.2147/OPTH.S84367>

Malafa, M. M., Coleman, J. E., Bowman, R. W., & Rohrich, R. J. (2016). Perioperative corneal abrasion: Updated guidelines for prevention and management. *Plastic and Reconstructive Surgery*, 137(5), 790e-798e. <https://doi.org/10.1097/PRS.0000000000002108>

- Melnyk, B. M., & Fineout-Overholt, E. (2019). *Evidence-based practice in nursing & healthcare: A guide to best practice (Fourth ed.)*. Wolters Kluwer.
- Morris, A., Bonanno, L., & Bennett, M. (2018). Effectiveness of corneal abrasion prevention interventions for adults undergoing general anesthesia for more than one hour: A systematic review protocol. *JBIS Database of Systematic Reviews and Implementation Reports*, 16(9), 1785–1790. <https://doi.org/10.11124/JBISRIR-2017-003670>
- O'Driscoll, A., & White, E. (2016). Care of the eye during anaesthesia and intensive care. *Anaesthesia and Intensive Care Medicine*, 18(1), 47-51.
<https://doi.org/10.1016/j.mpaic.2016.10.014>
- Papp, A. M., Justin, G. A., Vernau, C. T., Aden, J. K., Fitzgerald, B. M., Kraus, G. P., & Legault, G. L. (2019). Perioperative corneal abrasions after nonocular Surgery: A systematic review. *Cornea*, 38(7), 927-932. <https://doi.org/10.1097/ICO.0000000000001972>
- Segal, K. L., Fleischut, P. M., Kim, C., Levine, B., Faggiani, S. L., Banerjee, S., Gadalla, F., & Lelli Jr., G. J. (2014). Evaluation and treatment of perioperative corneal abrasions. *Journal of Ophthalmology*, 2014, Article 901901.
<https://link.gale.com/apps/doc/A421627502/HWRC?u=ncliveecu&sid=summon&xid=0d294c73>
- Taylor, M. J., McNicholas, C., Nicolay, C., Darzi, A., Bell, D., & Reed, J. E. (2014). Systematic review of the application of the plan-do-study-act method to improve quality in healthcare. *BMJ quality & safety*, 23(4), 290–298. <https://doi.org/10.1136/bmjqs-2013-001862>
- Vetter, T. R., Ali, N. M. K., & Boudreaux, A. M. (2012). A case-control study of an intraoperative corneal abrasion prevention program: Holding the gains made with a

continuous quality improvement effort. *The Joint Commission Journal on Quality and Patient Safety*, 38(11), 490-AP1. [https://doi.org/10.1016/S1553-7250\(12\)38065-3](https://doi.org/10.1016/S1553-7250(12)38065-3)

Appendix A
Literature Concept Table & Search Strategy

	Concept 1: Corneal Abrasions	Concept 2: Perioperative	Concept 3: Anesthesia
Keywords	Corneal Abrasions Corneal Injuries Ocular injuries Eye Care Ocular Care	Surgery Surgical Operative Perioperative Intraoperative	Anesthesia CRNA Certified Registered Nurse Anesthetist
PubMed (MeSH)	"corneal injuries"[MeSH Terms]	"surgical procedures, operative"[MeSH Terms] "general surgery"[MeSH Terms]	"anesthesia"[MeSH Terms]
CINAHL Subject Terms	Corneal Injuries Contusions and Abrasions	Perioperative Nursing Perioperative Medicine	Anesthesia Education, Nurse Anesthesia Anesthesia, General Anesthesia Recovery
Google Scholar	Corneal abrasion	Perioperative Intraoperative	-----

Note. Various combinations of the provided keywords, PubMed MeSH terms, and CINAHL subject headings were used to conduct literature searches in PubMed, CINAHL, and Google Scholar. Additionally, related articles, references, and professional websites were reviewed.

Appendix B

Literature Search Log

Search date	Database or search engine	Search strategy	Limits applied	Number of citations found/kept	Rationale for inclusion/exclusion of items
09/14/2021	PubMed	anesthesia AND (corneal injuries) AND surgery	10 years English	54 found/ kept 6	Included articles that pertained to incidence, prevalence, risk factors, prevention, intervention, physiology, pathophysiology, or interventions related to corneal abrasion for non-ocular surgeries during the perioperative period. Excluded any articles related to ocular surgery.
09/14/2021	CINAHL	((MH "Contusions and Abrasions") OR (MH "Corneal Injuries") OR "corneal abrasion") AND ((MH "Risk for Perioperative Positioning Injury (NANDA)") OR (MH "Perioperative Positioning Injury (Saba CCC)") OR (MH "Perioperative Injury Risk (Saba CCC)") OR (MH "Perioperative Nursing") OR (MH "Perioperative Medicine") OR (MH "Perioperative Injury Care (Saba CCC)") OR (MH "Perioperative Care (Iowa NIC)") OR "Perioperative") AND ((MH "Education, Nurse Anesthesia") OR	10 years English	4 found/kept 2	Included articles that pertained to incidence, prevalence, risk factors, prevention, intervention, physiology, pathophysiology, or interventions related to corneal abrasion for non-ocular surgeries during the perioperative period. Excluded any articles related to ocular surgery.

		(MH "Anesthesia Recovery") OR (MH "Anesthesia, General"))			
09/14/2021	Google Scholar	((Perioperative) OR (intraoperative)) AND ((eye care) OR (ocular care)) AND (Corneal abrasion)	10 years	8,960 found/kept 9 (Reviewed 10 pages of results)	Included articles that pertained to incidence, prevalence, risk factors, prevention, intervention, physiology, pathophysiology, or interventions related to corneal abrasion for non- ocular surgeries during the perioperative period. Excluded any articles related to ocular surgery.

Appendix C
Literature Matrix

Author, Title, Journal	Purpose & Conceptual Framework or Model	Design and Level of Evidence	Setting	Sample	Tool/s and/or Intervention /s	Results
Gonzalez-Birr, A. (2020). <i>Perioperative Corneal Abrasion: An Exploration of Educational Intervention Effectiveness and Impact on Prevention Practices</i> (Publication No. 27837882) [Doctoral Dissertation, Georgetown University]. ProQuest Dissertations Publishing.	“Determine anesthesia providers’ current level of understanding of perioperative corneal abrasion prevention practices. Also, determine what impact an educational in-service has on the anesthesia provider’s understanding of perioperative corneal abrasion prevention practices.” (p. 2) Conceptual Framework/Model: None noted by authors.	QI (VI)	Two mid-Atlantic teaching hospitals in the United States	8 Anesthesiologists 32 CRNAs	Pre- and post-intervention questionnaire Microsoft Excel R statistical programming software (v. 3.6.0) 2-tailed sample t-test	The educational intervention used did not have a statistical impact on providers’ understanding of perioperative corneal abrasions nor prevention methods 80% of providers felt an educational intervention would impact their corneal abrasion prevention methods
Kaye, A.D., Renschler, J.S., Cramer, K.D., Anyama, B.O., Anyama, E.C., Gayle, J.A., Armstead-Williams, C.M., Mosieri, C.N., Saus, J.A.,	To review proper care of the eye to decrease the occurrence of eye injuries.	Expert Opinion (VII)	Literature	Postoperative Patients	n/a	Description of risk factors, types of injury, diagnosis, detection, prevention, and treatment that

& Cornett, E.M. (2019). Postoperative management of corneal abrasions and clinical implications: A comprehensive review. <i>Current Pain and Headache Reports</i> , 23(7), Article 48.	Conceptual Framework/Model: None noted by authors.					could be potential standards.
Lichter, J. R., Marr, L. B., Schilling, D. E., Hudson, M. E., Boretsky, R. H., Barad, R. F., & Chelly, J. E. A. (2015). Department-of-anesthesiology-based management protocol for perioperative corneal abrasions. <i>Clinical Ophthalmology</i> , 9, 1689–1695.	“To assess the effectiveness of a formulated anesthesiology-based protocol, as well as clarify the incidence of corneal abrasions and examine some of its associated risk factors.” (p. 1690) Conceptual Framework/Model: None noted by authors.	QI (VI)	Community hospital in Pittsburgh, PA	91,064 non-ocular surgical patients	Anesthesiology-based protocol Wizard Wand pocket light Shapiro-Wilk test Two-sample Mann-Whitney U-test	The anesthesiology-based protocol demonstrated a statistically significant reduction in symptom to diagnosis to treatment times for corneal abrasions. “Anesthesiologists are capable of effectively managing simple ocular injuries.” (p.1694)
Malafa, M. M., Coleman, J. E., Bowman, R. W., & Rohrich, R. J. (2016). Perioperative corneal abrasion: Updated guidelines for prevention	“To update the prevention and treatment of perioperative corneal abrasion to improve	Expert Opinion (VII)	Literature	Surgical Patients	n/a	Updated standardized guidelines for prevention and management of corneal abrasions.

and management. <i>Plastic and Reconstructive Surgery</i> , 137(5), 790e-798e.	surgical patient care.” (p. 790e) Conceptual Framework/Model: None noted by authors.					
O'Driscoll, A., & White, E. (2016). Care of the eye during anaesthesia and intensive care. <i>Anaesthesia and Intensive Care Medicine</i> , 18(1), 47-51.	To improve anesthesiologists' knowledge of orbital anatomy, ocular physiology, and the mechanisms of perioperative eye injuries to help reduce their occurrence. Conceptual Framework/Model: None noted by authors.	Expert Opinion (VII)	Literature	Surgical Patients	n/a	Description of physiology of the eye and pathophysiology of corneal abrasions. Methods for corneal abrasion prevention with descriptions of advantages and disadvantages of each.
Papp, A. M., Justin, G. A., Vernau, C. T., Aden, J. K., Fitzgerald, B. M., Kraus, G. P., & Legault, G. L. (2019). Perioperative corneal abrasions after nonocular surgery: A systematic review. <i>Cornea</i> , 38(7), 927-932.	“To analyze the available data on perioperative corneal abrasions after non-ocular surgery to establish risk factors and trends that may lead toward future research and the development of new standard of care	Systematic review (V) of mixed study types	Literature	Surgical Patients	SPSS v22.0	“Longer procedures, general anesthesia, and advanced age are the most associated risk factors for corneal abrasions.” (p. 930) Prevention and education are the

	ocular protection practices during general anesthesia.” (p.927) Conceptual Framework/Model: None noted by authors.					key to reducing the incidence of perioperative corneal abrasions.
Segal, K. L., Fleischut, P. M., Kim, C., Levine, B., Faggiani, S. L., Banerjee, S., Gadalla, F., & Lelli Jr., G. J. (2014). Evaluation and treatment of perioperative corneal abrasions. <i>Journal of Ophthalmology</i> , 2014, Article 901901.	“To evaluate perioperative risk factors for corneal abrasion and to determine current care for perioperative corneal abrasions in a tertiary care setting.” (p. 1) Conceptual Framework/Model: None noted by authors.	QI (VI) Retrospective record review	Tertiary care	78,542 patients undergoing surgical procedures from 2007-2008	Chi-square test Wilcoxon’s ranks sum test R 2.10.0 statistical software	“Advancing age, general anesthesia, large estimated blood loss, same day. Admission, increased length of postoperative recovery in the PACU, and oxygen administration in the PACU are confirmed as posing greater risk for corneal abrasions.” (p. 3) Trendelenburg position was newly identified as posing a greater risk for corneal abrasions. “General anesthesia and

						advanced patient age are the most consistently cited risk factors.” (p.3) Treatment algorithms in conjunction with anesthesia PACU staff to expedite treatment of perioperative abrasions is recommended.
Vetter, T. R., Ali, N. M. K., & Boudreaux, A. M. (2012). A case-control study of an intraoperative corneal abrasion prevention program: Holding the gains made with a continuous quality improvement effort. <i>The Joint Commission Journal on Quality and Patient Safety</i>, 38(11), 490-AP1.	Implementation of a continuous quality improvement program to prevent intraoperative corneal injury. Conceptual Framework/Model: Plan, Do, Study, Act	QI (VI)	Department of anesthesiology in an academic medical center	50,151 surgical patients undergoing general anesthesia before and 113,044 after implementation of the prevention program.		A sustained decrease in intraoperative corneal abrasions following the implementation of the prevention program.

Note. Levels of evidence adapted from *Evidence-based practice in nursing and healthcare: A guide to best practice* (4th ed.), by B. M.

Melnyk and E. Fineout-Overholt, 2019, p. 131. Copyright 2019 by Wolters Kluwe

Appendix D

College of Nursing and Facility IRB Approval Forms



Click "download PDF" to save a copy of this page for your records.
Note: The IRB Office does not maintain copies of your responses.

Below is a summary of your
responses

[Download PDF](#)

Quality Improvement/Program Evaluation Self-Certification Tool

Purpose:

Projects that do not meet the federal definition of human research pursuant to 45 CFR 46 do not require IRB review. This tool was developed to assist in the determination of when a project falls outside of the IRB's purview.

Instructions:

Please complete the requested project information, as this document may be used for documentation that IRB review is not required. Select the appropriate answers to each question in the order they appear below. Additional questions may appear based on your answers. If you do not receive a STOP HERE message, the form may be printed as certification that the project is "not research", and does not require IRB review. The IRB will not review your responses as part of the self-certification process. For projects being done at Vidant Health, site support will be required. Please email crg.quality@vidanthealth.com to obtain site support from Vidant Health.

Name of Project Leader:

Justin Grady

Project Title:

Perioperative Corneal Abrasion: An exploration of Certified Registered Nurse Anesthetists' Preferences for Corneal Abrasion Prevention

Brief description of Project/Goals:

The purpose of this project is to assess CRNA's preferences for corneal abrasion prevention as well as their perception of adequacy of this quick reference guide as it pertains to eye protection. The purpose of this quality improvement project is to assess anesthesia providers' perceptions of adequacy of a newly developed Perioperative Corneal Abrasion Prevention Guide. Process: A Quick-Reference Perioperative Corneal Abrasion Prevention Guide, based upon accepted national guidelines, will be developed. Anesthesia providers at *insert site of project here* will be asked several questions (through Qualtrics) about their perceptions of the adequacy of the currently used perioperative corneal abrasion prevention techniques and preparedness for corneal abrasion prevention. An educational video about the use of the newly developed Perioperative Corneal Abrasion Prevention Guide will be made available to them, and they will be asked to use the tool for two weeks. Upon completion of the two-week utilization, they will be asked to complete a questionnaire about their perceptions of the adequacy of the tool. Qualtrics survey software will be used to deliver the intervention link and gather participant perceptions of acceptability and adequacy of the intervention prior to and post implementation of the project. No patient information will be recorded or maintained during this project.

Will the project involve testing an experimental drug, device (including medical software or assays), or biologic?

- ☐ Yes
☒ No

Has the project received funding (e.g. federal, industry) to be conducted as a human subject research study?

- ☐ Yes
☒ No

Is this a multi-site project (e.g. there is a coordinating or lead center, more than one site participating, and/or a study-wide protocol)?

- ☐ Yes
☒ No

Is this a systematic investigation designed with the intent to contribute to generalizable knowledge (e.g. testing a hypothesis; randomization of subjects; comparison of case vs. control; observational research; comparative effectiveness research; or comparable criteria in alternative research paradigms)?

- ☐ Yes
☒ No

Will the results of the project be published, presented or disseminated outside of the institution or program conducting it?

☒ Yes

☐ No

Would the project occur regardless of whether individuals conducting it may benefit professionally from it?

☒ Yes

☐ No

Does the project involve "no more than minimal risk" procedures (meaning the probability and magnitude of harm or discomfort anticipated are not greater in and of themselves than those ordinarily encountered in daily life or during the performance of routine physical or psychological examinations or tests)?

☒ Yes

☐ No

Is the project intended to improve or evaluate the practice or process within a particular institution or a specific program, and falls under well-accepted care practices/guidelines?

☒ Yes

☐ No

Based on your responses, the project appears to constitute QI and/or Program Evaluation and IRB review is not required because, in accordance with federal regulations, your project does not constitute research as defined under 45 CFR 46.102(d). If the project results are disseminated, they should be characterized as QI and/or Program Evaluation findings. Finally, if the project changes in any way that might affect the intent or design, please complete this self-certification again to ensure that IRB review is still not required. Click the button below to view a printable version of this form to save with your files, as it serves as documentation that IRB review is not required for this project. 11/14/2021

Center for Research & Grants

Quality Assurance/Quality Improvement Project vs. Human Research Study (Requiring IRB approval) Determination Form

This worksheet is a guide to help the submitter to determine if a project or study is a quality assurance/quality improvement (QA/QI) project or research study and is involving human subjects or their individually identifiable information and requires IRB approval as defined by the Health and Human Services (HHS) or Food and Drug Administration (FDA). Once completed, please email the form to the '_____'

A CRG team member will contact you with the results of their review and may request additional information to assist with their determination. The determination will be made in conjunction with the UMCIRB office.

Please contact the '_____' with any questions at _____

For more guidance about whether the activity meets the definition of Human Subjects Research see _____

Project Title: Perioperative Corneal Abrasion: An Exploration of Certified Registered Nurse Anesthetists' Preferences for Corneal Abrasion Prevention		
Funding Source: None		
Project Leader Name: Justin Grady/Maura McAuliffe	☐ Ed.D. ☐ J.D. ☐ M.D. ☐ Ph.D. ☐ Pharm.D. ☒ R.N. ☐ Other(specify):	
Job Title: ECU SRNA/ECU CRNA Faculty	Phone:	Email:
	Primary Contact (If different from Project Leader): Justin Grady	
	Phone:	Email:

Key Personnel/ Project Team members:

Name and Degree:	Department: (Affiliation if other than Vidant)	Email:
Justin Grady, SRNA	ECU Nurse Anesthesia Program	
Maura McAuliffe, PhD, CRNA	ECU Nurse Anesthesia Program	

QI/QA Assessment Checklist:

Consideration	Question	Yes	No
PURPOSE	Is the PRIMARY purpose of the project/study to: • IMPROVE care right now for the next patient? - OR • IMPROVE operations outcomes, efficiency, cost, patient/staff satisfaction, etc.?	☒	☐
RATIONALE 1	The project/study falls under well-accepted care practices/guidelines or is there sufficient evidence for this mode or approach to support implementing this activity or to create practice change, based on: • literature • consensus statements, or consensus among clinician team	☒	☐
RATIONALE 2	The project/study would be carried out even if there was no possibility of publication in a journal or presentation at an academic meeting. (**Please note that answering "Yes" to this statement does not preclude publication of a quality activity.)	☒	☐
METHODS 1	Are the proposed methods flexible and customizable, and do they incorporate rapid evaluation, feedback and incremental changes?	☒	☐
METHODS 2	Are patients/subjects randomized into different intervention groups in order to enhance confidence in differences that might be obscured by nonrandom selection? (Control group, Randomization, Fixed protocol Methods)	☐	☒
METHODS 3	Will there be delayed or ineffective feedback of data from monitoring the implementation of changes? (For example to avoid biasing the interpretation of data)	☐	☒
METHODS 4	Is the Protocol fixed with fixed goal, methodology, population, and time period?	☐	☒
RISK	The project/study involves no more than minimal risk procedures meaning the probability and magnitude of harm or discomfort anticipated are not greater in and of themselves than those ordinarily encountered in daily life or during the performance of routine physical or psychological examinations or tests.	☒	☐
PARTICIPANTS	Will the project/study only involve patients/subjects who are ordinarily seen, cared for, or work in the setting where the activity will take place?	☒	☐
FUNDING	Is the project/study funded by any of the following? • An outside organization with an interest in the results • A manufacturer with an interest in the outcome of the project relevant to its products • A non-profit foundation that typically funds research, or by internal research accounts	☐	☒

If all of the check marks are inside the shaded gray boxes, then the project/study is very likely QI and not human subject research. Projects that are not human subject research do not need review by the IRB.

In order to assess whether your project meets the definition of human subject research requiring IRB review or may qualify as a quality improvement/assurance activity, please provide the following information:

1. Project Summary: In the space provided below, please provide a summary of the purpose and procedures.

Purpose: The purpose of this quality improvement project is to assess CRNAs' preferences and practices regarding eye care and corneal abrasion prevention and whether or not they perceive a new corneal abrasion quick reference guide as a useful tool to prevent CAs.

Procedures: A quick reference guide based upon national guidelines will be utilized to guide anesthesia providers' perioperative eye care. Anesthesia providers at Vidant Roanoke Chowan will be asked several questions (through Qualtrics) about their perceptions of the adequacy of their current eye care practices during surgical anesthesia. A PowerPoint presentation about the use of the quick reference guide Interoperative Corneal Abrasion Prevention will then be made available to them, and they will be asked to use the quick reference guide for two weeks. Upon completion of the two-week utilization period participants will be asked to complete a questionnaire about their perceptions of the adequacy of the quick reference guide. Qualtrics survey software will be used to gather the anesthesia providers' perceptions of acceptability and adequacy of the corneal abrasion quick reference guide. No patient information will be recorded or maintained during this project.

2. If the Primary purpose of your project/study is for QA/QI, have you obtained approval from the operational leader within your department or health system [Please specify here whom and obtain their signature in the signature section below]:

☒ **Yes**

☐ **No** [Contact the appropriate operational leader for approval.]

Please note:

- By submitting your proposed project/study for QA/QI determination you are certifying that if the project/study is established to qualify as QA/QI project, you and your Department would be comfortable with the following statement in any publications regarding this project: "This project was reviewed and determined to qualify as quality improvement by the Vidant Health Center for Research and Grants."
- If you are submitting a Poster to Media Services for printing, you will need to also submit this Quality Improvement Worksheet or proof of your IRB Application and IRB Approval.
- If the _____ determines the activity is not human subject research, then any presentation, publication, etc. should not refer to the activity as "human subject research," "exempt research," or "expedited research."
- If you would like the _____ to verify that a project/study is not human subject research, please provide this form completed with the summary of your activity and any additional information to the _____ at _____ and the following will be completed and returned to you for your records.

NHSR vs. HSR Determination:

☒ **Not Human Subject Research:** The VH CRG has determined that based on the description of the project/study, approval by the IRB is not necessary. Any changes or modifications to this project may be discussed with the VH CRG at that time to ensure those changes do not elevate the project to human research that would need IRB approval.

☐ **Human Subject Research:** This project/study requires review by the IRB prior to initiation. An application in the electronic IRB submission system should be submitted.

Approval Signatures:

VH Operational Mgr/Leader: _____

Date: 3/9/2022

VH CRG Reviewer: _____

Date: 3/14/22

UMCIRB Office Staff Reviewer: _____

Date: 3/15/22Attestation of Understanding

My signature below indicates that I fully understand that HIPAA Privacy standards as they apply to Quality Projects Involving Protected Health Information and patient medical records as outlined below.

Under HIPAA's minimum necessary provisions, _____ must make reasonable efforts to limit PHI to the minimum necessary to accomplish the purpose of the use, disclosure or request.

Under HIPAA, a Covered Entity (i.e. _____) can disclose PHI to another CE (i.e. BSOM) for the following subset of health care operations activities of the recipient CE without needing patient consent:

- Conducting quality assessment and improvement activities
- Developing clinical guidelines
- Conducting patient safety activities as defined in applicable regulations
- Conducting population-based activities relating to improving health or reducing health care cost

_____ data utilized in this project should not be shared outside of the CE without a fully executed data use/sharing agreement. Vidant Health leadership reserves the opportunity to review all articles for dissemination/publication for which Vidant healthcare data has been utilized.

Justin D Grady
Project Leader Signature

02/17/2022
Date

Appendix E

Quick-Reference Guide

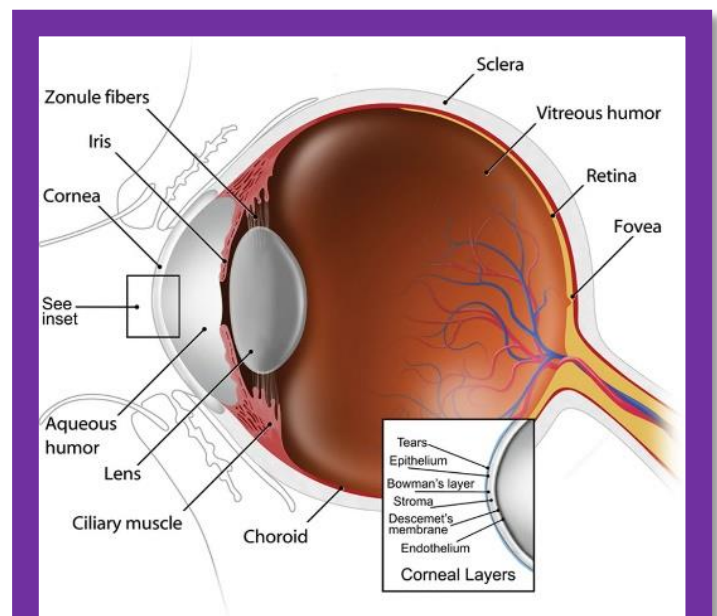
Risk Factors:	Incidence/Litigation	Sources of CAs:
- Advanced Age^{1,2,3,6} - SRNA as provider^{1,5} - Head and neck surgery^{2,5} - Graves' disease/exophthalmos^{2,5} - Lateral/prone/trendelenburg position^{1,2} - Prolonged surgery duration > 3.5 hours⁶ - Robotic surgery cases⁶ - Diabetes¹ - Low ASA status¹	2% of all malpractice claims^{2,4} - Incidence of CAs 0.64% overall⁶ - CAs account for 35% of all ocular injury claims and awards for ocular injuries are 4% higher than any other claim⁶	- Identification badges^{1, 4} - Stethoscopes¹ - Laryngoscopes^{1,4} - Oxygen facemasks^{1,2,4} - Pulse oximeter probe on dominant hand^{1,2,4} - Watch band^{2,4} - Surgical drapes^{2,4} - Bair hugger²

Pathophysiology

- Corneal abrasions are superficial injuries to the epithelial layer of the cornea that cause pain, photophobia, excessive tearing, headache, and blurry vision.
- They normally heal within 72 hours but cause patients extensive, unanticipated discomfort in addition to their post-operative pain^{2,4}
- One fifth of these injuries occur from mechanical trauma such as scratching the eyes post-surgery or from objects such as oxygen masks, badges, and surgical drapes as well as chemical injuries from substances such as antiseptics². Other factors that add to the risk of corneal abrasions are foreign bodies, contact lens, and dry eyes².
- During general anesthesia, contraction of the orbicularis oculi muscle is inhibited therefore putting patients at increased risk for corneal abrasions due to insufficient closing of the eyelid and subsequent drying of the cornea².
- General anesthesia also inhibits blink reflexes, tear production, and what is known as Bell's phenomenon.
 - Bell's phenomenon is the upward and outward movement of the globe when the eyes close. The cornea stays more exposed during a threat without this reflex intact, contributing to injury.

Assessment and Diagnosis

- Initial assessment and treatments can be completed by an anesthesiologist
- Abrupt onset of eye pain, blurry vision, photophobia, excessive tearing, foreign body sensation within 2 hours of procedure^{2,4}
- R/o foreign body: evert eyelids to assess for any foreign body. If foreign body present irrigate with topical anesthetic^{2,4}
- Assess visual acuity, EOMs, pupil reactivity⁴
- Definitive diagnosis: fluorescein staining reveals yellow green staining of basement membrane in presence of corneal abrasion^{2,4}



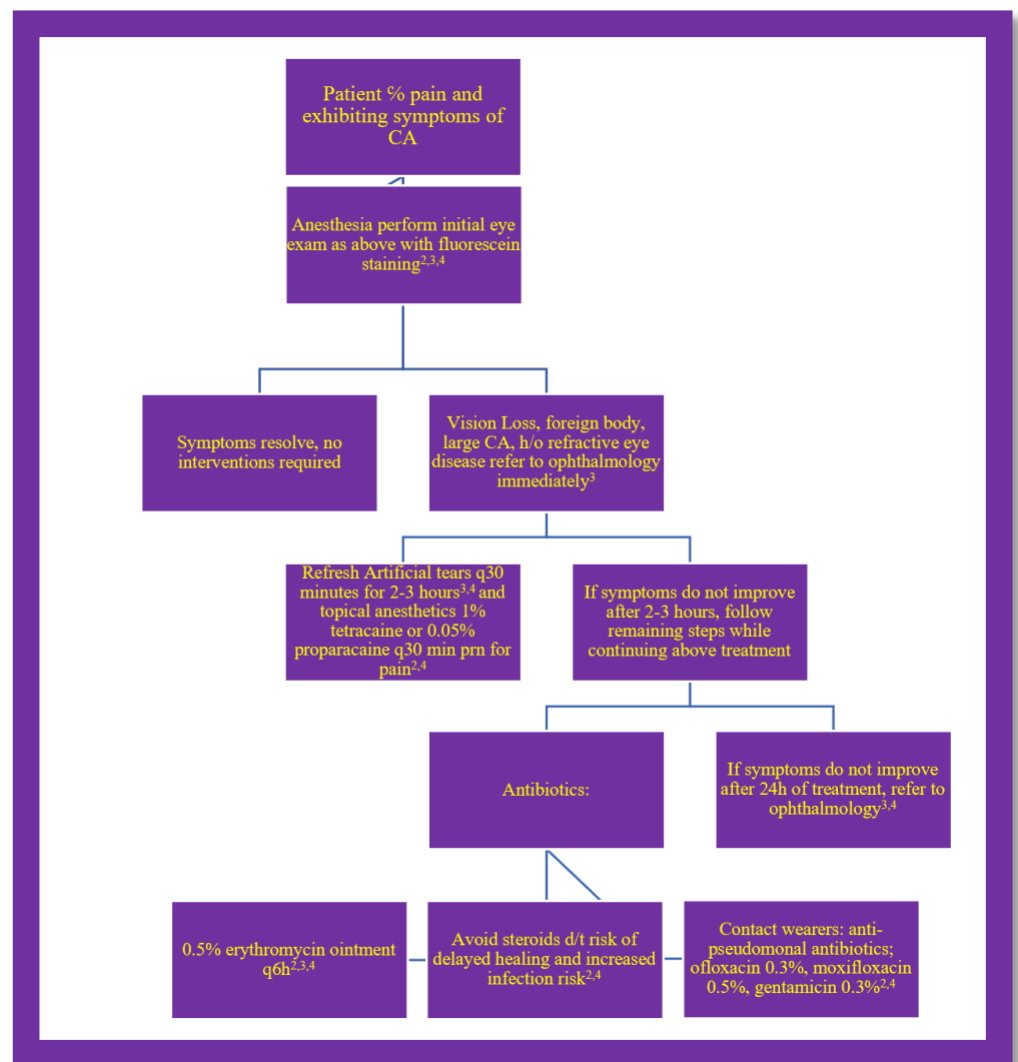


How do you tape your patients' eyes shut? Horizontal vs Vertical?

Interventions

- Secure eyelids with tape immediately after loss of lid reflex on induction and prior to securing the airway⁷
 - The tape should be placed horizontally across the entire lid line.^{1,7}
 - Use of Tegaderm to secure eyes in high risk cases^{1,4}
Tegaderm is water-tight and can prevent chemical injury with surgical prep solutions on the face²
- Use preservative-free 4% methylcellulose-based ointment to lubricate the eyes when taping is undesirable^{1,4}
- Paraffin based lubricant can absorb highly soluble anesthetics like Halothane and cause irritation¹
- Petroleum ointments are flammable - avoid with high FiO₂ and electrocautery near the face²
- Remove tape from upper to lower lid to reduce risk of mechanical trauma²

Stepwise Treatment Protocol



References

- Gixti, A., Sadri, M., & Watts, M. T. (2013). Corneal protection during general anesthesia for nonocular surgery. *The Ocular Surface*, 11(2), 109 – 118. <https://dx.doi.org/10.1016/j.jtos.2012.10.003>
- Kaye, A. D., Renschler, J. S., Cramer, K. D., Anyama, B. O., Anyama, E. C., Gayle, J. A., Armstead-Williams, C., Mosieri, C. N., Saus, J. A., & Cornett, E. M. (2019). Postoperative management of corneal abrasions and clinical implications: A comprehensive review. *Current Pain & Headache Reports*, 23(7), N.PAG. <https://doi.org/10.1007/s11916-019-0784-y>
- Lichter, J. R., Marr, L. B., Schilling, D. E., Hudson, M. E., Boretzky, R. H., Barad, R. F., & Chelly, J. E. (2015). A department-of-anesthesiology-based management protocol for perioperative corneal abrasions. *Clinical Ophthalmology (Auckland, N.Z.)*, 9, 1689-1695. <https://doi.org/10.2147/OPTH.S84367>
- Malafa, M. M., Coleman, J. E., Bowman, R. W., & Rohrich, R. J. (2016). Perioperative corneal abrasion: Updated guidelines for prevention and management. *Plastic and Reconstructive Surgery*, 137(5), 790e-798e. <https://doi.org/10.1097/PRS.0000000000002108>
- Martin, D. P., Weingarten, T. N., Gunn, P. W., Lee, K., Mahr, M. A., Schroeder, D. R., & Sprung, J. (2009). Performance improvement system and postoperative corneal injuries: Incidence and risk factors. *Anesthesiology*, 111(2), 320-326. <https://doi.org/10.1097/ALN.0b013e3181ae63f0>
- Papp, A. M., Justin, G. A., Vernau, C. T., Aden, J. K., Fitzgerald, B. M., Kraus, G. P., Legault, G. L. (2019). Perioperative corneal abrasions after nonocular surgery: A systematic review. *Cornea*, 38(7), 927 – 932. <https://dx.doi.org/10.1097/ICO.0000000000001972>

Appendix F

Emails to Participants

Initial Pre-Survey and PowerPoint Presentation Email

Dear [REDACTED] CRNAs,

Thank you for considering participation in my quality improvement project titled “Assessing the Adequacy of a Newly Developed Corneal Abrasion Prevention Guide in High-Risk Cases at a Small Rural Medical Center”. The purpose of this quality improvement project is to assess CRNAs’ preferences and practices regarding eye care and corneal abrasion prevention and their perception of the corneal abrasion quick reference guide as a useful tool for their practice to prevent CAs.

Participation is completely voluntary, but much appreciated, as it will serve to instruct my learning as I work to obtain skills in performing a quality improvement project. Your participation will involve completing a short pre-intervention survey, viewing a brief PowerPoint presentation, and utilizing a corneal abrasion quick reference guide in your practice for two weeks. At the end of the two-week implementation period, you will be asked to complete a short post-intervention survey regarding the use of the corneal abrasion quick reference guide.

Each survey and the PowerPoint presentation should take less than 10 minutes to complete. The questionnaires were created and are completed using Qualtrics ® survey software. The use of the corneal abrasion quick reference guide was developed based on a current review of the literature and falls within the currently accepted practice in your work area. Your participation is voluntary and responses will be kept confidential. The results of this QI study will be shared with you upon completion.

How to Participate

1. Complete the pre-intervention survey:
https://ecu.az1.qualtrics.com/jfe/form/SV_6h6kNlmXZtjGfk2
2. View a short PowerPoint presentation [attached to this email](#) outlining the use of the corneal abrasion quick reference guide
3. Utilize the corneal abrasion quick reference guide [attached to this email](#) in your practice for two weeks.

Again, thank you for your participation in this quality improvement project. I will be present at Vidant Roanoke Chowan in the operating room during the 2-week period but you may also reach out to me or Dr. Maura McAuliffe by email if you have any questions.

Sincerely,

Justin Grady, SRNA

ECU Nurse Anesthesia Program

Class of 2023

[REDACTED]

Dr. Maura McAuliffe, PhD, CRNA, FAAN, Project Chair

[REDACTED]

Pre-Survey and PowerPoint presentation Reminder Email

Hello [REDACTED] CRNAs,

I just wanted to send out a quick reminder about the ongoing DNP Project on corneal abrasion prevention. If you have already filled out the pre-intervention survey and viewed the PowerPoint presentation, thank you! If you haven't had a chance to yet, it's not too late to participate and would be very helpful and much appreciated. You can still access the pre-intervention survey and PowerPoint presentation at the links provided below and view the corneal abrasion quick reference guide attached to this email. After the end of the next week, I will begin sending out the post-intervention surveys.

Links:

Pre-Intervention Survey: https://ecu.az1.qualtrics.com/jfe/form/SV_6h6kNlmXZtjGfk2

[PowerPoint presentation attached to this email](#)

[Corneal Abrasion Quick Reference Guide attached to this email](#)

Please let me know if you have any questions and thank you again for your participation.

Sincerely,

Justin Grady, SRNA

ECU Nurse Anesthesia Program

Class of 2023

[REDACTED]

Dr. Maura McAuliffe, PhD, CRNA, FAAN, Project Chair

[REDACTED]

Post-Survey Email to Participants

Dear [REDACTED] CRNAs,

Thank you to everyone who has already completed the pre-intervention survey, viewed the PowerPoint presentation, and utilized the corneal abrasion quick reference guide for the last two weeks. It's now time to complete the brief post-intervention survey.

If you have not filled out a pre-intervention survey, I would really and truly appreciate your participation. You can still access and complete the pre-intervention survey here and view the PowerPoint presentation [attached to this email](#). The corneal abrasion quick reference guide is also [attached to this email](#) for your reference.

If you have already completed the pre-intervention survey, it would be great if you could also complete the post-intervention survey. The survey should take less than 5 minutes to complete.

Links:

Pre-Intervention Survey: https://ecu.az1.qualtrics.com/jfe/form/SV_6h6kNlmXZtjGfk2

Post-Intervention Survey: https://ecu.az1.qualtrics.com/jfe/form/SV_8zYicQMroVUbplk

If anyone has questions or issues with the links, please reach out to me via email. Again, thank you for your participation in this quality improvement project. You have helped me develop skills in performing a QI project in addition to developing effective skills as an anesthesia provider. I look forward to continuing to learn from you all!

Sincerely,

Justin Grady, SRNA

ECU Nurse Anesthesia Program

Class of 2023

[REDACTED]

Dr. Maura McAuliffe, PhD, CRNA, FAAN, Project Chair

[REDACTED]

Final Thank You Email to Participants

Dear [REDACTED] CRNAs,

I just wanted to say thank you so much for your help in completing my DNP Project. I have collected all the data that I need to proceed with data analysis and will then be finished with my paper. Once it's complete you all will be able to read it if you would like. If you liked the corneal abrasion quick reference guide, and found it to be useful, you can continue to use it in your practice and feel free to share it with other anesthesia providers. You can find a copy [attached to this email](#) for your future use.

Thank you again! I look forward to continuing to learn from you all in the future.

Sincerely,

Justin Grady, SRNA

ECU Nurse Anesthesia Program

Class of 2023

[REDACTED]

Dr. Maura McAuliffe, PhD, CRNA, FAAN, Project Chair

Appendix G

Participant Surveys

Pre-Intervention Survey



1. Have you or do you know of a colleague that has personally been involved in the care of a patient who had a corneal abrasion?

- ☐ Yes
☐ No

2. If you or a colleague were involved in the care of a patient who had a corneal abrasion, what was the cause of the injury? (select all that apply)

- ☐ a. Patient rubbing eyes upon emergence/recovery
☐ b. Tape or eye protection inadvertently removed during procedure
☐ c. Manual trauma from equipment such as stethoscope, ID badges, pulse ox probe, drapes, robotic surgical equipment
☐ d. Chemical trauma spilled into the eye such as surgical prep used in the facial area
☐ e. Other (comment)

3. What prevention measures do you routinely implement for eye protection during a standard induction of general anesthesia? (select all that apply)

- ☐ a. None
☐ b. Eye goggles/shield
☐ c. Tegaderm
☐ d. Medipore tape
☐ e. Paper tape
☐ f. Lubricant (VMC uses "Systane" 3% mineral oil and 94% white petroleum)
☐ g. Tape/tegaderm in combination with lubricant
☐ h. Other (comment)

4. What prevention measures do you implement for eye protection in patients and/or surgeries that you identify to be at high risk for corneal abrasions? (select all that apply)

- ☐ a. None
☐ b. Eye goggles/shield
☐ c. Tegaderm
☐ d. Medipore tape
☐ e. Paper tape
☐ f. Eye lubricant (VMC uses "Systane" 3% mineral oil and 94% white petroleum)
☐ g. Tape/tegaderm in combination with lubricant
☐ h. Other (comment)

5. Please comment to indicate any additional prevention measures not listed above that you take to protect patients from corneal abrasion. Suggested examples: placing pulse oximeter probe on the non-dominant hand, removing stethoscope or identification badges from the immediate area prior to intubation, vigilance strategies to prevent patient from rubbing the eyes during transport, additional foam padding around the patients eyes during high risk cases)

- ☐ a. None
- ☐ b. Comment

6. When do you routinely tape the eyes during a standard induction of general anesthesia?

- ☐ a. Before securing the airway
- ☐ b. After securing the airway

7. What types of surgery, patient positioning, and patient demographic/co-morbid conditions would you consider as high risk for perioperative corneal abrasions?

- ☐ Surgery
- ☐ Position
- ☐ Demographic/co-morbid conditions

8. During general anesthesia, how often do you routinely assess the eyes for protection from corneal abrasions (select all that apply)?

- ☐ a. Never
- ☐ b. Every 15 minutes
- ☐ c. Every 30 minutes
- ☐ d. During position changes
- ☐ e. During emergence

9. Please rate your confidence in your ability to identify patients at high risk for corneal abrasions.

- ☐ a. Not confident
- ☐ b. Somewhat confident
- ☐ c. Neutral
- ☐ d. Confident
- ☐ e. Highly confident

10. Please rate your confidence in your ability to take appropriate measures to prevent corneal abrasions.

- ☐ a. Not confident
- ☐ b. Somewhat confident
- ☐ c. Neutral
- ☐ d. Confident
- ☐ e. Highly confident

11. Please rate your confidence in your ability to assess, diagnose, and treat corneal abrasions.

- ☐ a. Not confident
- ☐ b. Somewhat confident
- ☐ c. Neutral
- ☐ d. Confident
- ☐ e. Highly confident

Post-Intervention Survey



1. During the past two weeks, have you been involved in any surgical cases where a corneal abrasion occurred?

- ☐ a. Yes
- ☐ b. No

2. During the past two weeks, how many surgical cases did you identify as high risk for corneal abrasions?

- ☐ a. 0
- ☐ b. 1-5
- ☐ c. 5-10
- ☐ d. 10-15
- ☐ e. > 15

3. During the past two weeks, did you perceive the handout to be useful for your practice to prevent corneal abrasions? Please comment why if so.

- ☐ a. Yes (comment)
- ☐ b. No

4. How likely are you to utilize the handout in the future to implement additional eye protective strategies in your practice?

- ☐ a. Highly unlikely
 - ☐ b. Unlikely
 - ☐ c. Neutral
 - ☐ d. Likely
 - ☐ e. Highly likely
-

5. After this intervention, have you made any changes to your practice to prevent corneal abrasions? Please comment on what you may have changed.

- ☐ a. Yes (comment)
 - ☐ b. No
-

6. Are there other eye protection strategies not listed on the reference handout that you would see as beneficial for others to know?

- ☐ a. Yes (comment)
 - ☐ b. No
-

10. After having access to this reference handout, please rate your confidence in your ability to take appropriate measures to prevent corneal abrasions.

- ☐ a. Not confident
- ☐ b. Somewhat confident
- ☐ c. Neutral
- ☐ d. Confident
- ☐ e. Highly confident

11. After having access to this reference handout, please rate your confidence in your ability to assess, diagnose, and treat corneal abrasions.

- ☐ a. Not confident
- ☐ b. Somewhat confident
- ☐ c. Neutral
- ☐ d. Confident
- ☐ e. Highly confident

12. Please comment on any potential barriers to the use of the reference handout and/or implementation of eye protection strategies at your facility.

7. How strongly do you agree or disagree with the following statement: After viewing the video and using the handout for the past two weeks, my awareness for the potential of perioperative corneal abrasion has increased.

- ☐ a. Strongly disagree
- ☐ b. Disagree
- ☐ c. Neutral
- ☐ d. Agree
- ☐ e. Strongly agree

8. In the future, if an Epic shortcut was created to allow for streamlined documentation of eye care strategies utilized during the case, would that be beneficial to you?

- ☐ a. Yes
- ☐ b. No

9. After having access to this reference handout, please rate your confidence in your ability to identify patients at high risk for corneal abrasions.

- ☐ a. Not confident
- ☐ b. Somewhat confident
- ☐ c. Neutral
- ☐ d. Confident
- ☐ e. Highly confident