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Original Article

The eye wash technique: A simple and effective technique for intraoperative ocular surface lavage

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ABSTRACT

Objectives: The author proposes an extremely effective and practical method of ocular surface hydrating and cleaning during anterior segment surgery, the Eye Wash Technique (EWT), in substitution for the traditional methods employing a syringe and cannula for ocular irrigation.

Materials and Methods: The EWT utilizes the intraocular irrigating solution (IS) used in the surgery. It is performed by employing the irrigating line of the phacoemulsification (phaco) machine or the irrigating fluid IV drip in case of manual cataract surgery. The eye irrigation is performed directly from the Luer end attachment of these irrigating lines, which is positioned above the inner cantus pointing to the globe's nasal limbal region. With the phaco machine pedal in position 1 (irrigation only) or in panel continuous irrigation mode in case of phaco surgery, or by opening the roller clamp of the IV drip line in case of manual surgery, IS flow ensues and is directed to the eye from a nasal direction to provide a steady flow to wash the exposed eye surface as well as the lid margins and lid speculum. The irrigation is maintained for two to five seconds with side-to-side jiggling if needed, to ensure complete ocular surface coverage. Cornea hydration is achieved and any unwanted material on the ocular surface is washed out.

Results: The EWT was easily incorporated into the surgical routine with no difficulty in adaptation to the technique or in its employment. The surgical time was not prolonged when employing the technique. The EWT effectively provided both corneal hydration and ocular surface cleaning every time it was used, with no need to resort to the traditional syringe and cannula irrigation method at any time.

Conclusion: The EWT should be incorporated into the anterior segment surgical routine and performed at the beginning of surgery, before inserting the intraocular lens, and at the end of the surgery; also, at any time during surgery should the need arise, enhancing anterior segment surgical visualization and safety.

Keywords: Ocular surface lavage, Ocular surface contaminants, Anterior segment visualisation, Toxic anterior segment syndrome prevention, Endophthalmitis prevention

INTRODUCTION

During anterior segment surgery, the surgeon regularly faces issues hampering good visualisation, a critical requirement in most surgical steps.[1-3] Corneal dryness, debris, oily ocular surface film, blood, dyes, ophthalmic viscosurgical devices (OVD) and conjunctival discharge are frequent occurrences that cause visualisation interference. In addition, the presence of contaminants or toxic/irritant substances on the ocular surface is a safety hazard, posing a risk of post-operative infection and inflammation should they gain access into the anterior chamber.[4-7]

Ensuring a hydrated cornea and a clean ocular surface free of unwanted material is essential to address these issues and achieve perfect anterior segment visualisation during cataract surgery.

The usual way to remove contaminants from the ocular surface during surgery is by irrigation using a disposable syringe with a cannula. Despite being simple and practical, this method has drawbacks compromising its effectiveness. Irrigating volume is low, usually insufficient to remove the unwanted material. The cannula jet's interrupted 'droplet flow' nature frequently causes bubbles or foam to form on the ocular surface, worsening the visualisation problem.

This article proposes an extremely effective and practical method of ocular surface cleaning and hydrating that overcomes these issues, named the eye wash technique (EWT).

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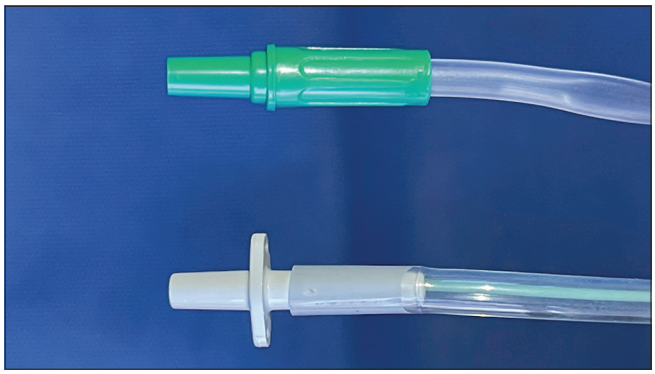
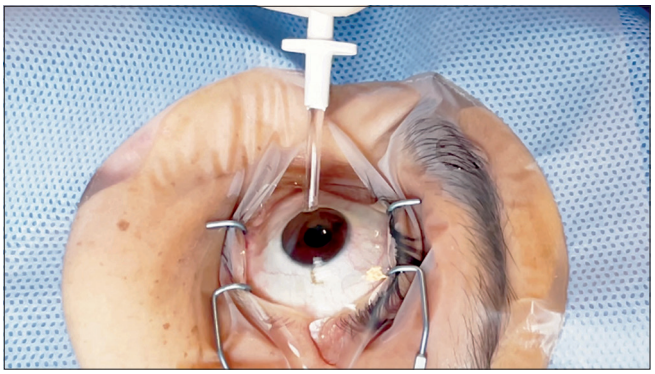


Figure 1: Luer end attachments of phacoirrigating line and standard IV drip line.

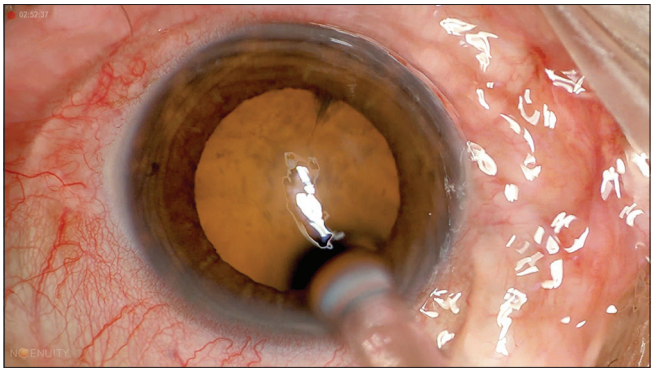
MATERIALS AND METHODS

The EWT utilises the intraocular irrigating solution (IS) used in the surgery, be it the regular balanced salt solution or Ringer Lactate. It can be performed by employing the irrigating line of the phacoemulsification (phaco) machine or the irrigating fluid IV drip in case of manual cataract surgery. The eye irrigation is performed directly from the Luer end attachment of these irrigating lines [Figure 1].

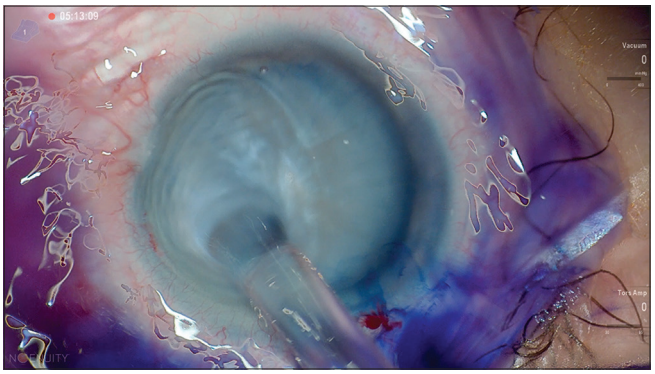
With the patient's eye already prepared and draped for surgery, the irrigating line Luer end attachment is positioned above the inner cantus, pointing to the globe's nasal limbal region. With the phaco machine pedal in Position 1 (irrigation only) or in panel continuous irrigation mode in case of phaco surgery or by opening the roller clamp of the IV drip line in case of manual surgery, IS flow ensues and is directed to the eye from a nasal direction, providing a steady flow that washes the whole exposed eye surface as well as the lid margins and lid speculum. The IS flow runs in a uniform temporal direction and falls into the eye drape fluid bag collector carrying all ocular surface resting material along. The irrigation is maintained for 2–5 s. If needed, side-to-side jiggling ensures complete ocular surface coverage [Video 1]. Cornea hydration is achieved and any unwanted material on the ocular surface is washed out [Videos 2 and 3]. In case of adherent material such as blood or ocular discharge, a cellulose sponge (preferably) or a cotton-tipped applicator can be used simultaneously to wipe the material from the ocular surface or the conjunctival fornices [Video 4]. The EWT can be performed during surgery on an ad hoc basis at any time. The positioning of the Luer end attachment can be moved to deliver the flow in different directions to address the situation needs better. Placement of a uniform layer of OVD over the cornea immediately after execution of the EWT prolongs its advantageous effects diminishing the need of its repetition and enhances anterior segment visualisation, being an excellent and advisable complementing technique [Video 5].



Video 1: The eye wash technique execution. Video is accessible from the portal.



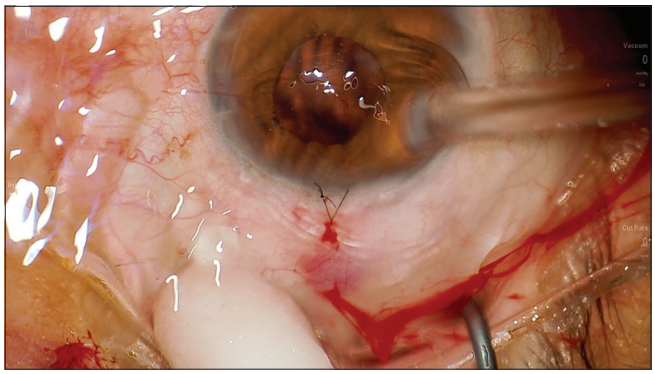
Video 2: Cornea hydration by the eyewash technique. Video is accessible from the portal.



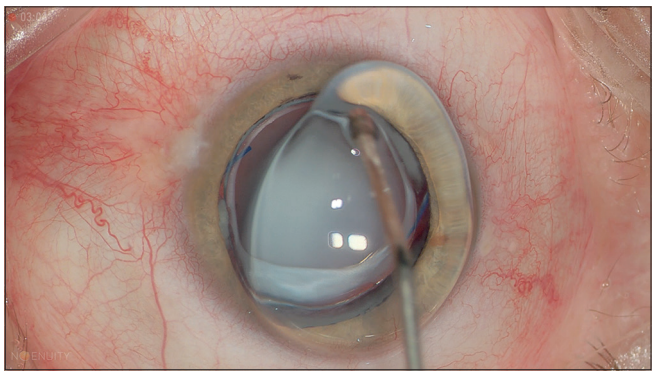
Video 3: Ocular surface cleaning by the eyewash technique. Video is accessible from the portal.

RESULTS

The EWT was noted to be easily incorporated into the surgical routine. No difficulty in adaptation to the technique or in its employment was noted. The surgical time was not prolonged when employing the technique. The EWT effectively provided both corneal hydration and ocular surface cleaning every time it was used, with no need to resort



Video 4: Enhancing the eye wash technique cleaning action with the use of a cotton-tipped applicator. Video is accessible from the portal.



Video 5: Placement of an OVD layer over the ocular surface after performance of the eye wash technique. Video is accessible from the portal.

to the traditional syringe and cannula irrigation method at any time. The three suggested moments for employing the technique were sufficient in the vast majority of surgeries due to its prolonged action; in rare occasions in surgeries with longer than 8-10 minutes duration, supplemental use was needed.

DISCUSSION

Ensuring adequate eye condition is essential for many reasons when operating.

Good optical clarity throughout surgery is essential in anterior segment procedures.[1,3] The presence of debris, conjunctival mucus, bubbles, blood and clots, dye, oily film from the eyelid glands, accumulated OVD and impurities in the ocular surface can severely interfere with good visualisation during surgery.

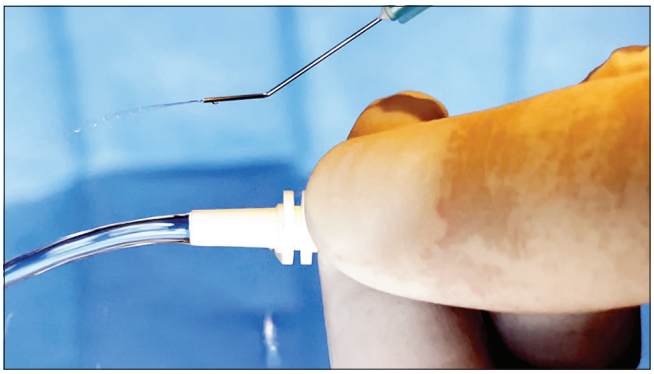
Lubrication of the corneal surface provides adequate corneal hydration and optimal optical clarity[2] by maintaining a uniform and clean fluid film over the cornea, a sine-qua-non condition for good visualisation of anterior segment structures. The integrity of the corneal epithelium is a prerequisite for that. Corneal epithelial dehydration not only hampers good intraoperative visualisation but also leads to post-operative corneal epithelial haze and oedema, epithelial debridement with an increased risk for infection and a prolonged post-operative recovery.[2]

Adequate preparation and draping of the eye are essential to provide a clean and disinfected eye surface for anterior segment surgery,[4] but not always sufficient in achieving this goal or ensuring the permanence of this condition throughout the whole surgery. Most cases of cataract surgery post-operative endophthalmitis are caused by bacteria from the patient's own conjunctival and periocular flora.[8-11] Bacteria were detected in the surgical drape fluid catch bag in a significant proportion of patients when the eye was irrigated with saline,[12] showing their permanence in the ocular surface during surgery. Bacteria from the conjunctival and periocular flora routinely gain access to the anterior chamber and are still present at the end of a significant proportion of surgeries.[8,9,13,14] Ocular surface fluid reflux wash in the conjunctival and periocular flora through the incision margins.[9,15] To reduce the risk of post-operative endophthalmitis, adequate eye preparation for surgery should reduce or eliminate the eyelid and conjunctival flora both preoperatively and intraoperatively,[4] keeping the number of bacteria left *in situ* to a minimum[15] and minimising their entry into the anterior chamber.[16]

Complete removal of Povidone-iodine (PVP-I) solutions used in eye preparation from the ocular surface before surgery is necessary because it has been shown that prolonged corneal epithelial exposure time to solutions with concentrations above 0.5% and corneal endothelium intraocular exposure to 0.05 mL or more to PVP-I solutions with concentrations above 0.5% cause toxic effects on these corneal structures.[17] To put this in perspective, the antiseptic PVP-I solution used for skin preparation has a 10% concentration and the eye drop PVP-I solution concentration is 5%.

Fluorescein-stained conjunctival fluid has been directly visualised entering the anterior chamber during cataract surgery.[9] Through this means, any material present on the ocular surface during surface can gain access to the anterior chamber. PVP-I solution, cilia, blood, mucous discharge, fibrous material from the surgical field and cotton-tipped applicators and other foreign bodies.[6,18,19] The presence of extraneous materials in the anterior chamber may elicit severe inflammatory reactions and lead to grave consequences to the eye.[7,20] Toxic anterior segment syndrome (TASS) is an acute sterile anterior chamber inflammatory reaction, usually developing between 12 and 48 h after surgery,[21-23] though late-onset TASS has also been reported.[24] It is a devastating complication of intraocular surgery.

Efficient ocular surface lavage in the operative period is beneficial in maintaining corneal hydration and



Video 6: Comparison of irrigating solution flow volume and characteristics between the eyewash technique and syringe with 25G cannula. Video is accessible from the portal.

diminishing the presence of extraneous material in the operative field.

The traditional means of ocular surface irrigation using a syringe with a cannula are very ineffective for various reasons. The IS flow obtained with this technique is inherently low due to the small cannula bore (usually 25G) and limited to a maximum of 10 cc in each instance (the largest syringe volume usually available at the surgical table). The fluid stream immediately separates into small droplets as soon as it leaves the cannula. This interrupted nature causes bubbles and foam to form on the ocular surface, defeating the intended purpose. The option of utilising a syringe without a cannula for ocular surface irrigation also has many disadvantages. Refilling is necessary after each use, requiring a recipient with IS to be present at the surgical table or to fill the syringe directly from the irrigating line after each use. The IS total volume delivered is limited by the syringe volume and may not be enough to achieve adequate cleaning of the ocular surface. Flow control when delivering fluid through a syringe without a cannula is poor, which can lead to a too strong fluid stream hitting the eye causing splashes, patient discomfort and distress and also imprecision when directing the flow to the eye.

Conversely, the EWT provided IS volume flow is substantial (10–20 cc in 5 s), efficiently removing and carrying along ocular surface deposited material. It flows in a laminar way, thus avoiding splash and bubble/foam formation, being instantly distributed over a sizeable ocular surface area and enhancing surface material removal. In most cases, an irrigating time of 5 s is sufficient to remove all resting material from the ocular surface. This is a good flow duration to be standardised for the technique, thus avoiding the need for simultaneous monitoring and judgment to decide when to stop irrigating as it is necessary when irrigation is done with a syringe and cannula, making the technique swift and consistent.

[Video 6] shows IS flow from both EWT and syringe with a 25G cannula simultaneously for comparison.

The EWT effectively addresses the above-mentioned issues: It provides adequate corneal hydration and a clean ocular surface to ensure optical clarity, diminishes the ocular surface and exposed lid margins bacterial load and removes contaminants and extraneous material.

Besides effectiveness, practicability and low cost are two main features that any technique must present to encourage use and incorporation into the surgical routine. To perform the EWT, no added instrument or consumable is needed since the IS irrigating lines are already set up and available in cataract surgery. The technique is rapid to be performed. An unparalleled amount of fluid can be quickly delivered by the EWT, ensuring efficiency, with no special devices needed, and at any moment during surgery. These positive attributes encourage the surgeon or assistant to use it whenever needed. In the author's extensive experience of over 10 years performing the EWT, in most cases, the initial lavage was sufficient to maintain the ocular surface clean and hydrated throughout the whole cataract surgery without the need for repeating it. The lavage or hydration employing the syringe and cannula demands many repetitions due to its low volume flow and reduced cleansing capability.

CONCLUSION

The EWT should be incorporated into the anterior segment surgical routine and performed at the beginning of surgery after eye preparation and placement of the lid speculum, before inserting the intraocular lens, and at the end of the surgery, as these are crucial moments when ocular surface hydration and cleanliness is demanded,[25] and also at any time during surgery should the need arise, enhancing anterior segment surgical visualization and safety.

Declaration of patient consent

Patient's consent not required as patients identity is not disclosed or compromised.

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Conflicts of interest

There are no conflicts of interest.

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