Irrigation port hydration in phacoemulsification surgery

Hisaharu Suzuki¹
Yoichiro Masuda²
Yuki Hamajima¹
Hiroshi Takahashi³
¹Department of Ophthalmology, Nippon Medical School Musashikosugi Hospital, Kawasaki City, Kanagawa, ²Department of Ophthalmology, The Jikei University, Katsushika Medical Center, Tokyo, ³Department of Ophthalmology, Nippon Medical School, Tokyo, Japan

Background: In most cases, hydration is performed by water injection into the stromal tissue with a needle. The technique is simple, however it is sometimes troublesome.

Purpose: We describe a simple technique for hydrating the corneal stroma in cataract surgery using an irrigation port.

Patients and methods: The technique began by pushing the irrigation port against the corneal stroma for a few seconds during phacoemulsification, which generated edema in the corneal incision that subsequently prevented leakage. This procedure is called the hydration using irrigation port (HYUIP) technique. A total of 60 eyes were randomized and placed in two groups, 30 eyes underwent surgeries using the HYUIP technique (HYUIP group) and 30 eyes underwent surgeries without the HYUIP technique (control). The three points evaluated during each surgery included 1) the occurrence of anterior chamber collapse during the pulling out of the I/A tip after inserting the intraocular lens, 2) the need for conventional hydration, and 3) watertight completion at the end stage of surgery.

Results: The anterior chamber collapse and the need for conventional hydration were significantly smaller in the HYUIP group compared to the control group. Regarding the self-sealing completion, no significant difference was observed between the two groups.

Conclusion: The HYUIP technique is an effective method for creating self-sealing wound. In addition, this technique helps to prevent anterior chamber collapse.

Keywords: cataract surgery, hydration, irrigation and aspiration, phacoemulsification, wound, self-sealing

Introduction

Today, most phacoemulsifications are sutureless surgeries in which the wound is self-sealing. The most common technique utilized for creating this wound is through the use of stromal hydration. Compromised wound integrity in the form of fluid leakage, which can induce bacterial invasion from the ocular surface, is believed to be a risk factor for endophthalmitis.¹ Therefore, creating a watertight wound is an important and necessary step for the safety of the procedure. When extracting the irrigation/aspiration (I/A) tip after the insertion of the intraocular lens, opening of the wound often occurs, thereby leading to collapse of the anterior chamber. Consequently, surgeons need to hydrate the wound site stroma to make the wound watertight and reconstruct the anterior chamber integrity. In most cases, hydration is performed by water injection into the stromal tissue with a needle. The technique is simple, but is sometimes troublesome. Here, we report a very simple technique that can be used to carry out hydration prior to pulling out the tip from the anterior chamber.
Patients and methods

This study was a randomized controlled trial. Approval was obtained from the Institutional Review Board/Ethics Committee of Nippon Medical School Musashikosugi Hospital prior to the start of the study. Before enrollment to the study, written informed consent was obtained from all patients. From December 2016 through February 2017, one surgeon (HS) performed all cataract surgeries at Nippon Medical School Hospital Musashikosugi Hospital. All incisions were created just anterior to the transconjunctival single-plane sclerocorneal incision using a 2.4 mm wide steel keratome. The planned length of all incisions was approximately 2.0 mm with no enlargement. We used a Stellaris phaco machine (Bausch + Lomb, Aliso Viejo, CA, USA) in all cases. Phacoemulsification was performed through a superior transconjunctival single-plane sclerocorneal incision using an ophthalmic viscosurgical device of sodium hyaluronate 2.3% (Healon5; Allergan Medical Optics, Santa Ana, CA, USA), an ultrasound power output of 20%, and a vacuum pressure of 150 mmHg. The bottle height setting was 70 cm. Following phacoemulsification and cortical cleanup, a 1-piece foldable acrylic intraocular lens was inserted via an injector through the wound. After removing the ophthalmic viscosurgical device from the anterior chamber, the irrigation port of the I/A tip was used to press the upper, lower, and lateral sides of the wound in order to create hydration for the corneal stroma. The pushing time for each side was 5–10 seconds (Figure 1). Then, once the chip was returned to the anterior chamber, it was quickly pulled out. A Medical Quick Absorber was subsequently used to confirm whether there was leakage from the wound (Figure 2). This procedure is referred to as the hydration using irrigation port (HYUIP) technique.

A total of 60 eyes were randomized and placed in two groups, with 30 eyes undergoing surgeries using the HYUIP technique (HYUIP group) and 30 undergoing surgeries without the HYUIP technique (control). Randomization was done

Figure 1 HYUIP technique 1.

Notes: (A) The irrigation port of the tip was used to push the left side of the corneal incision for 5–10 seconds. (B) The procedure listed in part A was repeated for the right side. (C) The procedure listed in part A was repeated in the up and down directions. (D) After pushing the three sides, the tip was immediately drawn back inside the anterior chamber.

Abbreviation: HYUIP, hydration using irrigation port.
Irrigation port hydration in phacoemulsification surgery by the envelope method. The three points evaluated during each surgery included 1) the occurrence of anterior chamber collapse during the pulling out of the I/A tip after inserting the intraocular lens, 2) the need for conventional hydration, and 3) watertight completion at the end stage of surgery. The data in the two groups were compared using Fisher’s test. Any differences with a P-value of <0.01 were considered statistically significant. In addition, the wound integrity was observed in eyes in both groups using the Rescan 700 OCT device (Zeiss, Jena, Germany).

Morphology of the central corneal endothelium was analyzed using a specular microscope, and cell density, coefficient of variation, and percentage of the hexagonal cell were determined. Statistical analysis was performed using the unpaired Student’s t-test. All P-value <0.01 were considered significant. Excel (Microsoft, Redmond, WA, USA) was used for statistical analysis.

Results
The clinical study comprised 60 patients (60 eyes); there were 30 patients in the HYUIP group and 30 patients in the control group. In all cases, the surgery lasted fewer than 10 minutes and the effective phaco time was generally fewer than 10 seconds.

Table 1 summarizes the findings for the occurrence of anterior chamber collapse, the need for conventional hydration, and the watertight completion at the end stage of surgery. The anterior chamber collapse and the need for conventional hydration were significantly smaller in the HYUIP group compared to the control group. Regarding the self-sealing completion, no significant difference was observed between the two groups. Optical coherence tomography (OCT) images were obtained during the phacoemulsification using the Rescan 700 OCT device (Zeiss) in both groups. In the HYUIP group, images included the area around the self-sealing wound that was created using an

<table>
<thead>
<tr>
<th>Evaluation items</th>
<th>HYUIP (30 eyes)</th>
<th>Control (30 eyes)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anterior chamber collapse</td>
<td>4</td>
<td>24</td>
<td>&lt;0.01*</td>
</tr>
<tr>
<td>Conventional hydration</td>
<td>0</td>
<td>24</td>
<td>&lt;0.01*</td>
</tr>
<tr>
<td>Posthydration suture</td>
<td>0</td>
<td>0</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Note: *Statistically significant difference (Fisher’s test).
Abbreviation: HYUIP, hydration using irrigation port.
irrigation port (Figure 3). In control, the degree of corneal edema was greater than HYUIP. However, there were some cases in which slight detachment of Descemet’s membrane was observed around the incision (Figure 4). All patients in both groups exhibited excellent vision, with corrected visual acuity being 0.1 logMAR or better, and experienced no complications after the surgery. There was no significant difference in degree of decrease (%) in cell density at 1-month postop between 2 groups (Figure 5); also, no significant difference was observed in the coefficient of variation and the hexagonal cell ratio between 2 groups.

Discussion
Sutureless cataract surgery has now become a standard technique. However, there is concern that endophthalmitis could occur after these surgeries. During cataract surgery, it is well known that there are essentially two opportunities for bacteria to enter the eye. The first possibility of entry occurs at the time of surgery, while the second opportunity is during the early postoperative period prior to the epithelialization of an unsutured wound. To prevent invasion of bacteria, stromal hydration has been the most common technique used to augment the self-sealing wound dynamics of corneal incisions. To hydrate a wound, water injection using a needle is the most popular method. However, when using a needle, there are potential complications that need to be taken into consideration. Bradshaw et al reported that use of a slip-lock cannula during the stromal hydration step of what was otherwise a routine cataract procedure resulted in a case of iris perforation, zonule rupture, hyphema, and vitreous
In conclusion, the HYUIP technique is an effective method for creating a self-sealing wound. In addition, this technique helps to prevent anterior chamber collapse.

Acknowledgment
We thank Kotaro Oki and Hisaharu Iwaki for their helpful suggestions regarding this technique.

Disclosure
The authors report no conflicts of interest in this work.

References
