Unity VCS: A Comparison Study Evaluating Corneal Clarity and Thickness at Day 1 and Day 8 Post Op

An investigator-initiated clinical trial

1. TITLE PAGE

Protocol Number:	IM-25-02
Amendment Number:	Version 1.0
IRB/ERC.	Advarra IRB 6100 Merriweather Drive, Suite 600 Columbia, Maryland 21044
Sponsor Name and Address:	Ivan Mac, MD Metrolina Eye Associates 4101 Campus Ridge Road, Suite 200 Matthews, NC 28105 **(funding only; this is an investigator-initiated study IIT # 98711335)** Alcon 6201 South Freeway Fort Worth, TX 76134-2001, USA
Test Articles:	Unity VCS (with Unity handpiece and 4D motion) and Centurion Vision System (with Ozil handpiece and torsional motion)
Investigator:	Ivan Mac, MD

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3. Investigator Agreement

I confirm that I have read and that I have understood the protocol named "Unity VCS: A Comparison Study Evaluating Corneal Clarity and Thickness at Day 1 and Day 8 Post Op and understand the study product's operation. I agree to conduct this study in strict accordance with the protocol and will prioritize the rights, safety, privacy, and well-being of study subjects in accordance with the following.

- The ethical principles covered under the Declaration of Helsinki.
- Any applicable laws and regulations, including those that cover data privacy.
- Requirements for reporting any serious adverse events.

Signature of Investigator: _____

Investigator's Name (Print): _____

Date: _____

Name of Facility: _____

Facility Address: _____

4. General Study Information

Objective:	To investigate the central corneal thickness and the corneal clarity when preforming phacoemulsification at a lower IOP setting using Unity VCS compared to a higher IOP setting with the Centurion Vision System with Ozil.
Test Article:	Unity VCS (with Unity handpiece and 4D motion)
Control Article:	Centurion Vision System (with Ozil handpiece and torsional motion)
Sample Size:	105 subjects (bilateral cataract surgery; 210 eyes)
Study Population:	Subjects undergoing sequential bilateral cataract surgery that have the same cataract grade based on the LOCS III grading (including nuclear clarity and opalescence) in both eyes. ▪ Cataracts with a minimum grade of 2.0 for nuclear opalescence and 2.0 for nuclear color according to the LOCS III score are required to be considered for the study.
Number of sites:	One
Study Design:	Prospective, two-surgeon, randomized, paired-eye study; patients undergoing sequential, uncomplicated bilateral phacoemulsification using Unity VCS 4D phaco with a lower IOP setting in one eye and with a higher IOP in the other eye using Centurion Vision System with Ozil.
Masking:	None
Primary Variables:	Central corneal thickness at post-operative day 1 and corneal clarity at post-operative day 1.

Secondary Variables:	Central corneal thickness at post-operative day 8, corneal clarity at post-operative day 8, total aspiration time, total ultrasound time, and CDE.
Exploratory Variable:	Mesopic contrast sensitivity at post-operative day 1.
Study Duration:	Pre-operative to 8 days post-operative

The study will be registered with clinicaltrials.gov

This study will be conducted to match the protocol and follow any applicable requirements.

5. Introduction

Modern cataract surgery has seen remarkable advances, largely due to the introduction of sophisticated phacoemulsification platforms. These various platforms allow surgeons to achieve rapid vision correction and enhanced clarity for patients. One such recent advancement is the UNITY VCS platform from Alcon. This current technology is designed to maintain a lower IOP throughout the cataract phacoemulsification and aspiration process.

Maintaining a lower IOP during cataract surgery is crucial as it mimics the natural conditions of the eye, allowing a reduction in stress and trauma usually associated with cataract removal. This approach to cataract surgery using the UNITY VCS is expected to result in several significant benefits for patients. It is expected to lead to greater corneal clarity with less corneal edema immediately after surgery, due to the cornea experiencing less disturbance and swelling. Evidence is needed to confirm that the UNITY VCS operating at a lower IOP delivers greater corneal clarity and less corneal edema in the post-operative period compared to the Alcon Centurion system with Ozil at a higher IOP.

6. Objective

To investigate how central corneal thickness and corneal clarity are affected when preforming phacoemulsification at a lower IOP setting using Unity VCS compared to how the two parameters are affected when preforming phacoemulsification using Centurion with Ozil at a higher IOP setting.

7. Subjects

7.1. Subject Population

The subjects in this study will consist of individuals presenting to the study site that meet the inclusion criteria mentioned in the protocol who desire to undergo standard phacoemulsification cataract surgery. 105 subjects will be enrolled in total, with both eyes included within the study. Subjects will be informed about the details of the study and will sign a patient information and consent form to participate.

7.2. Inclusion Criteria

To be eligible for this study, subjects must have both eyes meet all the following inclusion criteria:

- No prior ocular surgery, including corneal refractive surgery.
- Bilateral visually significant cataracts, similar in density with 1 grade of each other (a minimum grade of 2.0 on the LOCS III scale) prior to surgery.

- An equal dilated pupil size of ≥6mm without the use of pupil expansion devices.
- Un-remarkable systemic health (can have a history of controlled type II diabetes and hypertension if the subject has a normal OCT at the baseline visit).
- A normal CCT range of 540 μm ± 50 and no evidence of Fuchs' dystrophy

To be eligible for the exploratory endpoint, subjects must have both eyes meet the following criteria as well as the criteria above:

- No other ocular pathology besides age-related cataracts.

7.3. Exclusion Criteria

A subject will be considered ineligible for this study if they, or either eye, meet any of the following criteria:

- A history of corneal disease
- Media opacification not due to a cataract
- Compromised zonular stability
- Retinal or retinal vascular pathology.
- A history of glaucoma or any uncontrolled systemic disease.

The primary investigator can, at any time, declare a patient ineligible or non-evaluable if medical evidence indicates that they are not suited for the trial.

8. Study Details

8.1. Study Design

This study is a prospective, two-surgeon, randomized, paired-eye study. Subjects will undergo sequential, uncomplicated bilateral phacoemulsification using the Unity VCS 4D phaco operating at a lower intraocular setting in one eye and the Centurion Vision System with Ozil operating at a higher IOP setting in the other eye.

The primary outcome measurements for this study are the following:

- Central corneal thickness at post-op day 1
- Corneal clarity at post-op day 1

The secondary outcome measurements for this study are the following:

- Central corneal thickness at post-operative day 8
- Corneal clarity at postoperative day 8
- Total aspiration time

- Total ultrasound time
- Cumulative dissipated energy (CDE)

The exploratory outcome measurement for this study is the following:

- Mesopic contrast sensitivity at post-op day 1.

8.2. Steps to Minimize Bias

To minimize the double-organ bias, one of the subject's eyes will be randomly assigned to have cataract surgery performed using the Alcon Unity VCS system and the other eye will be assigned to undergo cataract surgery using the Alcon Centurion Vision System with Ozil a week later. Subjects will be selected based on their own interest and the surgeons' belief that they are suitable for cataract surgery.

All measurements and procedures in the study will be standardized to minimize any bias. Post- operative treatments and medications will be standardized to minimize bias.

9. Study Procedure

9.1. Subject Enrollment and Informed Consent

All subjects participating in this study will be required to meet the inclusion criteria and sign an approved informed consent document. Consent from each subject will be obtained before gathering any data for the study. All signed consent documents for this study will be maintained by the principal investigator and a signed copy will be provided for each subject.

9.2. Study Visits

All subjects will participate in 6 total visits during the study. Visits will include a baseline visit, two surgical visits (a week apart), a post operative day one visit for the first surgical eye, a post-operative day one visit for the second surgical eye combined with a post operative day eight visit for the first eye, and a post operative day eight visit for the second surgical eye. The visit schedule is displayed in the table below.

	Baseline Visit	First Surgical Visit	Post Op Day 1 (first eye)	Second Surgical Visit	Post Op Day 1 (2^{nd} eye) / Post	Post Op day 8 (2^{nd} eye)

					Op Day 8 (1st eye)	
CCT Measured with Pentacam	X		X		X	X
Corneal Clarity Measured with Pentacam	X		X		X	X
Total Ultrasound Time		X		X		
Total Aspiration Time		X		X		
CDE		X		X		
Mesopic Contrast Sensitivity			X		X (only 2nd eye)	

9.3. Study Methodology

Patients will undergo sequential bilateral cataract surgery with the same cataract grade (based on LOCS III grading) in both eyes. Both surgeries will be included within one week of each other.

The first surgical eye will be randomly assigned at the day of the surgery to be performed with either the Alcon Unity VCS system using 4D or the Alcon Centurion Vision System with Ozil. Surgery with the Unity VCS arm will be performed with a lower IOP setting (< 40). Surgery with the Centurion with Ozil arm will be performed with a higher IOP setting (≥ 60).

For each surgical procedure, a 2.3 mm temporal clear corneal incision will be performed using a trapezoidal blade. Each surgical case will be performed with Viscoat and Provisc viscoelastics. Anesthesia for the surgery will include topical lidocaine with MKO melt or crushed Xanax.

Horizonal phaco-chop techniques with pre-established and optimized fluid system settings will be standardized to the maximum extent possible. Each surgical system's settings are displayed below.

	IOP (mmHg)	Vacuum (mmHg)	Asp Flow (cc/min)	Other Settings
Centurion	≥ 60	Sculpt: 130 Chop: 575 Epi: 450	Sculpt: 26 Chop: 42 Epi: 35	Irrigation Factor: 1.3 Torsional Amplitude: 60 Sculpt and Chop: 60 Epi: 35 Longitudinal Pulse Duration: 94 Vacuum Threshold: 94 Longitudinal/Torsional Ratio: 0.8
Unity VCS	<40	As close as possible to Centurion settings (identical is preferred if possible)	As close as possible to Centurion settings (identical is preferred if possible)	4D Phaco

Surgeries will be performed 1 week apart from each other. During the procedures, intraoperative phacoemulsification metric will be recorded from the GUI: total aspiration time, total ultrasound time, and CDE.

All post operative treatments and medications will be standardized to include Prednisolone Acetate/Moxifloxacin/Bromfenac 3 in 1 on a standardized schedule (4-3-2-1 weekly for each eye).

All measurements of central corneal thickness will be measured with a Pentacam. Corneal clarity will be measured with a Pentacam Corneal Optical Densitometry in a dark room or with a drape placed over the subject.

Post operative visits will occur on days 1 and 8 following the surgery for both eyes. Post operative day 1 for the second eye and post operative day 8 for the first eye will fall on the same day so the visits will be combined.

Mesopic contrast sensitivity will be completed on both post operative day 1 visits with 25 subjects that will undergo bilateral monofocal IOL implantation. Subjects are required to have no co-morbidities other than age-related cataracts. Testing for this parameter will be completed using the Pelli-Robson contrast sensitivity chard with a 3cd/ m2 LED illumination cabinet. Subjects will sit 1 meter from the cabinet to the outer canthus of the eye for testing.

9.4. Discontinued Subjects

Subjects can be discontinued from the study at any time based on the judgement of the primary investigator. Reasons for discontinuation include an adverse event, lost to follow up, a subject decision unrelated to an adverse event, a protocol violation, treatment failure, or other.

10. Analysis Plan

All study analysis will be performed using SATA software (v16.1, College Station, Texas). All continuous variables will be summarized using mean and standard deviations. The results of the tests of normality on each measure (the Shapiro-Wilk test) will determine whether the paired t-test or the Wilcoxon signed rank test will be used to evaluate the hypothesis.

A graphical testing strategy will be employed to control type one error at the 0.05 significance level due to the multiple hypotheses involved in the study. Each primary hypothesis will be tested against a 0.025 significance level. If either primary hypothesis is rejected, the secondary endpoints will be tested at the 0.025 significance level in hierarchical fashion. If both primary hypotheses are rejected, the secondary endpoints will be tested at the 0.05 significance level. If all of the secondary hypotheses are rejected at a 0.025 level of significance, the primary hypothesis unrejected at the 0.025 level will be retested at the 0.05 significance level.

Descriptive statistics (mean, standard deviation, etc) will be collected for the following endpoints: CCT at post op day 8, corneal clarity at post op day 8, and total aspiration time.

A mixed effects linear regression will be performed to test the trend overtime for CCT by group, accounting for paired data. Another mixed effects linear regression will also be performed to test the trend over time in corneal clarity by group, accounting for paired data.

11. Sample Size Justification.

Assuming a power of 80 percent, a significance level of 0.025, and a paired eye design, older studies (Rauen 2024, Spaulding 2025, Liu 2023, Hovanesian 2025, and Kokubun 2022) a difference of means of central corneal thickness on post op day 1 is expected to be around 24.4 μm with a standard deviation of 76.1. While no data is available examining corneal clarity, a closely related endpoint is corneal edema. A difference in means for corneal edema on post op day 1 is expected to be 0.027 with a standard

deviation of 0.6. It is expected that a study population of 105 patients, or 210 eyes, will provide sufficient data to characterize a difference in performance between the two cataract surgery systems.

12. Confidentiality of the Study

This study is confidential and will not be discussed with anybody not involved in the study. Results will be submitted for a publication and a presentation of the study will be made to deliver at meetings and conferences. A manuscript will be submitted to journals for the study to be published. The names of subjects and other identifying information will not be included in any of the materials published from this study. Information collected will only be used for study purposes and will not be sold to any third parties.

13. Adverse Events and Quality Complaints

Study subjects will have the opportunity at each visit to mention any problems they are experiencing, and the investigator will inquire about any adverse events directly.

If any adverse events are found to have taken place, an adverse event form will be filled (AEF) will be filled out. A separate form is required for every event that takes place. Documentation surrounding an adverse event must include the date of symptom onset, outcome, date of resolution, severity, remedying steps, and a relationship to the study treatment. Regardless of severity, all adverse events will be reported to a medical monitor. Serious adverse events will be reported to the IRB/IEC according to their requirements.

The primary investigator will determine whether the adverse event occurred due to the study treatment or because of outside factors. An assessment of causality will also be performed by the medical monitor of the study.

14. Ethical Considerations

This study will be conducted following the ICH guidelines in compliance with Good Clinical Practices. All applicable regulations and requirements will be adhered to. This study will also be held in compliance with the Institutional Review Board (IRB) and will obtain approval by an IRB/ethics committee prior to beginning.

15. References

1. Rauen MP, Joiner H, Kohler RA, O'Connor S. Phacoemulsification using an active fluidics system at physiologic vs high intraocular pressure: impact on anterior and posterior segment physiology. J Cataract Refract Surg. 2024 Aug 1;50(8):822-827. doi: 10.1097/j.jcrs.0000000000001457. PMID: 38595209.
2. Spaulding J, Hall B. Efficiency of phacoemulsification handpieces with high and low intraocular pressure settings. J Cataract Refract Surg. 2025 Mar 1;51(3):218-221. doi: 10.1097/j.jcrs.0000000000001581. PMID: 39602355.
3. Liu Y. et al. Comparison of the clinical outcomes of Centurion active fluidics system with a low IOP setting and gravity fluidics system with normal IOP setting for cataract patients with low corneal endothelial cell density. Front Med 10:1294808 (2023)
4. Kokubun, T. et al. Verification for the usefulness of normal tension cataract surgery. The 126th Annual Meeting of the Japanese Ophthalmological Society (JOS) (Osaka, Japan, 2022).
5. Hovanesian, Rauen. ASCRS 2025. Surgical Efficiency and Postoperative Corneal Clarity with Near Physiologic Vs High IOP Settings during Phacoemulsification. https://ascrs.confex.com/ascrs/25am/meetingapp.cgi/Paper/107679
6. Rauen AAO 2024. Phacoemulsification at High IOP and Physiologic IOP: Impact on Anterior and Posterior Segment Physiology