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CLINICAL TRIAL REPORT

# Preoperative Educational Video Viewing is Associated with a Reduced Incidence of Subconjunctival Hemorrhage Following Intravitreal Anti-VEGF Injection

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**Objective:** To assess whether preoperative viewing of an educational procedural video reduces the incidence and severity of subconjunctival hemorrhage (SCH) following intravitreal anti-VEGF injections (IVI), and improves patient experience.

**Methods:** In this surgeon-blind randomized controlled trial conducted at a single tertiary care center (NCT07002372), treatment-naïve patients scheduled for their first IVI were prospectively enrolled and randomized to either an intervention group (video viewing) or a control group (no video viewing). All participants completed the State-Trait Anxiety Inventory-State (STAI-S) before and after the injection. SCH incidence and area were assessed via standardized post-injection photographs analyzed using ImageJ software. Additional outcomes included patient-reported pain scores, heart rate, procedure time, and surgeon-rated cooperation.

**Results:** A total of 108 patients were enrolled, of whom 103 completed the study, which was fewer than the initially planned sample size. Baseline demographics were similar between groups. SCH occurred in 21/51 (41.2%) patients in the intervention group versus 36/52 (69.2%) in the control group ($P = 0.004$), though SCH area did not differ significantly. Logistic regression analysis revealed that the use of anticoagulant medication was positively associated with the occurrence of SCH (OR = 3.252; 95% CI, 1.166–9.071; $P = 0.024$), whereas watching an educational video prior to IVI was associated with a lower risk of SCH (OR = 0.275; 95% CI, 0.115–0.656; $P = 0.004$). Anxiety scores decreased post-procedure in both groups. In the intervention group, anxiety decreased modestly after video viewing (28.54 ± 10.40 to 27.00 ± 8.78, $P = 0.052$). Patients rated the video as helpful for understanding (8.75/10), calming nerves (8.44/10), and improving cooperation (8.55/10). No significant differences were observed in pain scores, heart rate, procedure time, or surgeon-rated cooperation.

**Conclusion:** Preoperative procedural video viewing reduces the incidence of SCH and improves patients' understanding of IVI. Given its simplicity and ease of implementation, this approach may serve as a practical adjunct to enhance patient experience in clinical practice.

**Plain Language Summary:** In this surgeon-blinded randomized trial including 103 patients undergoing their first intravitreal injection (IVI), preoperative educational video viewing significantly reduced the incidence of subconjunctival hemorrhage and was independently associated with a lower risk of hemorrhage. Patients reported better understanding of the procedure, reduced anxiety, and improved cooperation. These findings support the use of procedural videos as a simple, low-cost strategy to enhance patient experience during IVI.

**Keywords:** intravitreal anti-VEGF injections, subconjunctival hemorrhage, preoperative educational video, patient experience

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## Introduction

Intravitreal injections (IVI) of anti–vascular endothelial growth factor (anti-VEGF) agents are the mainstay treatment for a range of retinal diseases, including wet age-related macular degeneration (wAMD), cystoid macular edema secondary to diabetic retinopathy (DME) or retinal vascular occlusions (RVO), and myopic choroidal neovascularization (PM-CNV).[1] Reported rates of serious IVI-related complications are relatively low, with incidences of endophthalmitis ranging from 0.019% to 0.07%, retinal tears and detachments from 0.01% to 0.08%, and iatrogenic cataract from 0.021% to 0.09%.[2–4] In contrast, subconjunctival hemorrhage (SCH) is the most common adverse event following IVI.[5,6] Although SCH does not impair visual acuity, its cosmetic appearance can negatively affect patients' quality of life, leading some to avoid social interactions until resolution.

IVI itself can be anxiety-provoking, particularly for first-time patients who directly witness the needle approaching their eye, which can heighten procedural anxiety and subsequently exacerbate perceived pain.[7] Because IVI is often administered monthly over several years, reducing procedure-related pain and minimizing SCH incidence is essential for improving patient experience and long-term treatment adherence.

Various pharmacological strategies have been shown to mitigate injection-related discomfort and hemorrhage. Topical anesthetics such as proparacaine and lidocaine gel effectively reduce procedural pain, while additional measures, including cold anesthetic drops, cold antiseptic application, vasoconstrictive agents, and technical modifications (eg, smaller-gauge needles and optimized injection sites), have been reported to reduce pain and SCH incidence.[6,8–13] However, these approaches may increase cost and procedural complexity. In addition to pharmacological strategies, non-pharmacological interventions such as patient education, counseling, audiovisual information delivery, and music therapy have been explored as means to improve patient understanding, reduce preoperative anxiety, enhance cooperation during medical procedures, and improve overall patient experience.[14–16]

While surgeons aim to avoid visible conjunctival and episcleral vessels during injection, patient-related factors may also influence the risk of SCH. Subtle behavioral responses during the procedure, such as involuntary eye movement, eyelid squeezing, or increased periocular muscle tension, may affect injection stability and increase the likelihood of vessel injury. These responses may be influenced by patients' familiarity with the procedure and psychological state, although this relationship has not been fully established. Therefore, we hypothesized that pre-procedure educational video viewing may improve patient familiarity with IVI and reduce behavioral responses during the procedure, thereby potentially reducing the incidence of SCH and improving patient experience.

In this study, we aimed to evaluate whether pre-procedure educational video viewing, a simple and cost-effective strategy, can effectively reduce SCH incidence and improves patient experience.

## Materials and Methods

Treatment-naïve patients scheduled for their first IVI of anti-VEGF agent due to retinal diseases were prospectively enrolled in this surgeon-masked randomized controlled trial (NCT07002372) conducted at the Eye Center, The Second Affiliated Hospital of Zhejiang University School of Medicine, from May 2025 to August 2025. This study was conducted in accordance with the tenets of the Declaration of Helsinki. Ethical approval was obtained from the Institutional Review Board of The Second Affiliated Hospital of Zhejiang University School of Medicine (No. 20250092). Written informed consent was obtained from all study participants before inclusion of the study.

The exclusion criteria includes age below 18 years old, history of previous eye surgeries, best corrected visual acuity in the better eye worse than 0.3, the target eye is complicated with neovascular glaucoma, unable to communicate fluently due to significant hearing impairment, accent or cognitive impairment. Patients were initially screened from the IVI schedule based on the inclusion and exclusion criteria, and eligibility was reconfirmed in the IVI waiting area. Individuals who met the criteria and agreed to participate provided written informed consent.

Patients were randomized (1:1) into either an intervention group (video viewing) or a control group (no video viewing) using a computer-generated randomization sequence generated by an independent investigator, with allocation concealed until assignment. The sample size was calculated a priori assuming a SCH incidence of 50% in the control group and 30% in the intervention group, with 80% statistical power and a two-sided α of 0.05, resulting in a required

total sample size of 182 participants. Patients in the video-viewing group watched a 1-minute animated video (Video S1) explaining the IVI procedure on a 13-inch tablet during their waiting time. All patients, regardless of group assignment, received a printed information sheet outlining pre-, intra-, and post-IVI instructions at the time of scheduling. Baseline demographic and clinical data, including age, sex, hypertension history, current use of anticoagulant medication, education level, and indication for IVI, were collected.

All patients underwent a standardized IVI procedure performed by three experienced physicians (JLH, ALS, and FZ). The procedure included local anesthesia with Oxybuprocaine Hydrochloride Eye Drops (Benoxil® 0.4%, 0.5 mL: 2 mg; Santen Pharmaceutical Co., Ltd., Japan), periocular and conjunctival disinfection with povidone-iodine ophthalmic solution, irrigation with balanced salt solution, injection of 0.05 mL anti-VEGF agent using a 32-gauge needle, and compression of the injection site for at least 3 seconds. In our clinical setting, injections were performed with patients in the fully supine position and the surgeon standing at the head of the patient. Under this configuration, the superior quadrant (approximately the 10 to 2 o'clock positions) was routinely used, at approximately 3.5–4 mm posterior to the limbus. The procedure duration was recorded from initiation of ocular irrigation to needle withdrawal.

Immediately following the procedure, an anterior segment photograph focused on the conjunctiva was captured using a Leica operating microscope (Leica Microsystems, Wetzlar, Germany) at 6× magnification, when patients were asked to look downward (Figure 1). These photographs were used to evaluate the presence of subconjunctival hemorrhage (SCH) and to measure the SCH area using ImageJ software (Version 1.54; National Institutes of Health, Bethesda, MD, USA). Grading was independently performed by two ophthalmologists (JJX and WXZ) who were masked to group allocation. The SCH area measurements were averaged for analysis. In cases of substantial discrepancy, the images were jointly reviewed to reach consensus.

All participants completed the State-Trait Anxiety Inventory-State (STAI-S) questionnaire both before and after the injection in the waiting room of IVI. Participants in the video-viewing group completed an additional STAI-S assessment after watching the video. At the end of the procedure, patients were asked to complete self-reported assessments of pain, understanding of the procedure, and the video's effectiveness in relieving anxiety and improving cooperation, while physicians rated patient cooperation on a scale from 1 to 10, with 10 representing the highest level of each parameter. Patients' and physicians' ratings were recorded independently and were blinded to each other's evaluations.

All data are presented as mean ± standard deviation (SD). Interobserver reliability between the two graders' SCH measurements was assessed using the intraclass correlation coefficient (ICC) with a two-way random-effects model. Categorical data were analyzed using Fisher's exact test. Continuous variables were compared using an independent samples *t*-test. Correlations between variables were evaluated using Pearson or Spearman rank correlation coefficients. Paired t-tests or ANOVA were used to compare STAI-S scores across different time points. Factors might increase the chance of bleeding other than pre-IVI video viewing were included as potential predictors in a multivariable logistic regression model to assess their association with SCH. A two-sided P value <0.05 was considered statistically significant. Statistical analyses were performed using IBM SPSS Statistics for Windows, Version 31.0 (IBM Corporation, Armonk, NY, USA).

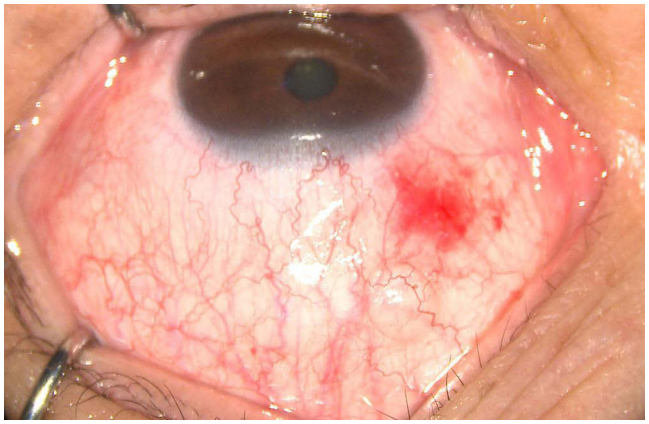

**Figure 1** Anterior segment photograph of a 56-year-old female who received intravitreal injection (IVI) in the left eye for diabetic macular edema (DME). The image was captured focusing on the conjunctiva using a Leica operating microscope (Leica Microsystems, Wetzlar, Germany) at 6× magnification.


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## Results

A total of 122 potential candidates were initially screened by nurses during the IVI schedule. Fourteen individuals were excluded due to a history of IVI at another hospital, prior ocular surgeries, poor vision, presence of NVG, or communication difficulties related to hearing or language problems. Ultimately, 108 participants were randomized into the intervention and control groups. Two patients in the video group were unable to complete the questionnaire and withdrew from the study. In the control group, one patient was excluded after randomization due to inability to complete the procedure according to protocol, as excessive anxiety resulted in marked prolongation of the injection time (>200 seconds). In total, 103 participants completed the study (Figure 2).

Baseline demographics were comparable between the two groups (Table 1). No significant differences were observed in the proportion of patients with a history of hypertension ($P$ = 0.929) or the use of anticoagulant medications ($P$ = 0.622). The overall distribution of education levels was also similar between groups, although the video group included more patients with primary school education, whereas most patients in the control group had attained junior high school and above education. Importantly, education level was not correlated with baseline anxiety ($P$ = 0.427), post-IVI anxiety ($P$ = 0.357), or post-video anxiety ($P$ = 0.828).

At the end of the IVI visit, patients in the video group rated the video highly in terms of improving understanding of the procedure (mean score, 8.75/10), with no significant influence of education level ($P$ = 0.632). They also reported that the video was helpful for alleviating anxiety (8.44/10) and enhancing cooperation (8.55/10).

Anxiety scores significantly decreased post-procedure in all patients (28.74 ± 9.11 to 24.40 ± 7.56, $P$ < 0.001), although no significant differences were observed between the two groups at either baseline or the final assessment. In the intervention group, anxiety decreased modestly after video viewing (28.54 ± 10.40 to 27.00 ± 8.78, $P$ = 0.052). No significant differences were found in patients' heart rate during injection, procedure time, surgeon-rated cooperation or patients-rated pain scores.

SCH occurred in 21/51 (41.2%) patients in the intervention group versus 36/52 (69.2%) in the control group ($P$ = 0.004). The ICC for SCH area measurements between the two ophthalmologists was 0.725 (95% CI, 0.523–0.889; $P$ <

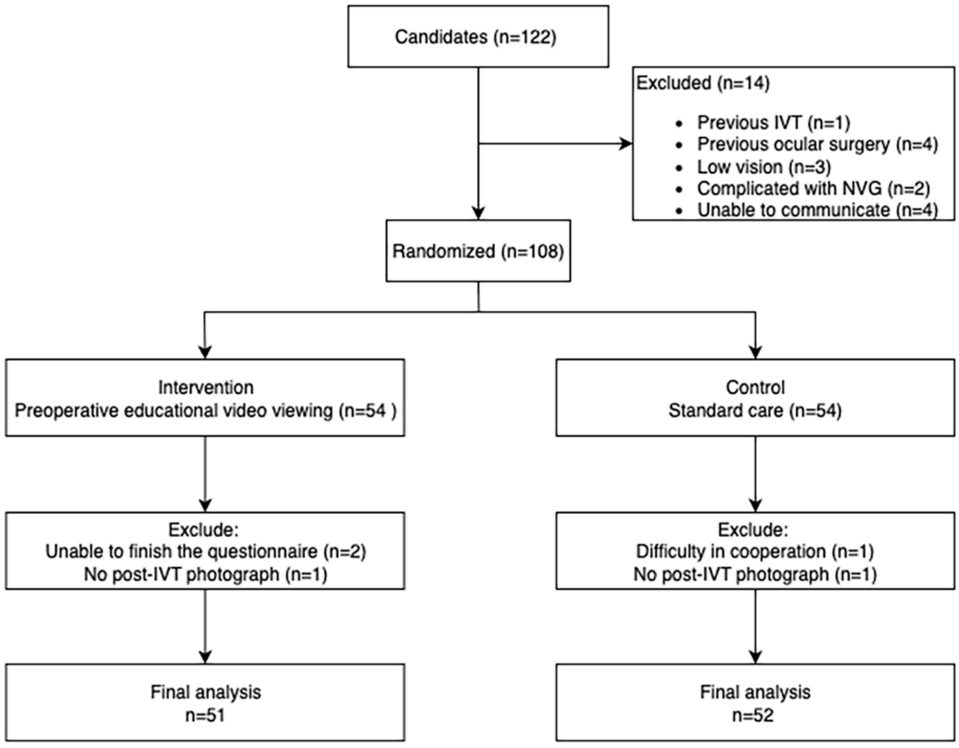


**Figure 2** CONSORT flow diagram illustrating the enrollment, allocation, and analysis of participants in the study.

**Table 1** Demographic Characteristics and Intravitreal Injection (IVI)-Related Metrics of Patients in the Intervention and Control Groups

| Characteristics | Intervention Group (n=51) | Control Group (n=52) | *P* value |
|---|---|---|---|
| Age (years) | 60.3±12.3 | 62.4±13.1 | 0.399 |
| Male gender | 27 (52.9%) | 31 (59.6%) | 0.554 |
| Hypertension history | 23 (45.1%) | 23 (44.2%) | 0.929 |
| Anticoagulant medicine | 13 (25.5%) | 16 (30.8%) | 0.662 |
| Education Level | | | 0.256 |
| Primary school<br>Junior High school<br>Senior high school<br>Collage and above | 21 (41.2%)<br>11 (21.6%)<br>8 (15.7%)<br>11 (21.6%) | 14 (26.9%)<br>20 (38.5%)<br>8 (15.3%)<br>10 (19.2%) | |
| Indications for IVI | | | 0.696 |
| wAMD<br>DME<br>RVO<br>PM-CNV<br>others | 9 (17.6%)<br>18 (35.3%)<br>18 (35.3%)<br>3 (5.9%)<br>3 (5.9%) | 12 (23.1%)<br>15 (28.8%)<br>19 (36.5%)<br>1 (1.9%)<br>5 (9.6%) | |
| SCH | 21 (41.2%) | 36 (69.2%) | 0.004* |
| SCH area (pixels) | 11,196.49±18,306.97 | 20,908.53±34,675.92 | 0.095 |
| Anxiety level | | | |
| Before IVI<br>*Before Video Viewing<br>After Video viewing<br>After IVI | 28.54±10.40<br><br>27.00±8.78<br>24.46±7.60 | 28.91±7.90<br><br>/<br>24.35±7.62 | 0.216<br><br><br>0.775 |
| HR during IVI | 81±14 | 80±13 | 0.905 |
| Procedure time (seconds) | 48.2±9.9 | 51.4±25.6 | 0.423 |
| Surgeon-rated cooperation | 7.8±1.3 | 7.4±2.0 | 0.280 |
| Pain score | 3.31±2.1 | 3.31±2.3 | 0.994 |

**Note**: *P < 0.05, considered statistically significant.
**Abbreviations**: IVI, intravitreal injection; wAMD, wet age-related macular degeneration; DME, diabetic macular edema; RVO, retinal vein occlusion; PM-CNV, myopic choroidal neovascularization; SCH, subconjunctival hemorrhage; HR, heart rate.

0.001). Although SCH area did not differ significantly between groups, the mean SCH area was smaller in the intervention group (11,196.49 ± 18,306.97 pixels) compared to the control group (20,908.53 ± 34,675.92 pixels; $P$ = 0.095), suggesting a potential trend toward reduced hemorrhage extent, which may be clinically relevant in terms of reduced cosmetic impact and improved patient acceptance.

Multivariable logistic regression analysis identified viewing the educational video before IVI as a protective factor associated with reduced SCH (OR = 0.275; 95% CI, 0.115–0.656; $P$ = 0.004), whereas the use of anticoagulant medications was positively associated with SCH occurrence (OR = 3.252; 95% CI, 1.166–9.071; $P$=0.024) (Table 2).

**Table 2** Logistic Regression Analysis of Factors Associated with Subconjunctival Hemorrhage (SCH) Following Intravitreal Injection (IVI)

| | Occurrence of SCH After IVI | | | |
|---|---|---|---|---|
| | Univariable Analysis | | Multivariable Analysis | |
| | OR (95% CI) | *P* value | OR (95% CI) | *P* value |
| Age | 0.990 (0.960–1.022) | 0.539 | | |
| Male gender | 1.647 (0.746–3.638) | 0.217 | | |
| Hypertension history | 2.405 (1.084–5.338) | 0.031* | 1.721 (0.685–4.329) | 0.248 |
| Anticoagulant medicine | 3.615 (1.437–8.871) | 0.005* | 3.252 (1.166–9.071) | 0.024* |
| Education level | | | | |
| Primary school | Reference | / | | |
| Junior high school | 0.952 (0.309–2.935) | 0.932 | | |
| Senior high school | 0.708 (0.230–2.183) | 0.548 | | |
| Collage and above | 0.667 (0.177–2.513) | 0.549 | | |
| Indication for IVI | | | | |
| wAMD | Reference | / | | |
| DME | 0.667 (0.106–4.196) | 0.666 | | |
| RVO | 0.354 (0.062–2.017) | 0.242 | | |
| PM-CNV | 0.352 (0.063–1.975) | 0.235 | | |
| Others | 0.111 (0.001–1.776) | 0.120 | | |
| Video | 0.311 (0.138–0.700) | 0.005* | 0.275 (0.115–0.656) | 0.004* |
| Anxiety level before IVI | 1.027 (0.978–1.078) | 0.293 | | |
| HR during IVI | 0.985 (0.956–1.015) | 0.327 | | |
| Procedure time | 0.997 (0.978–1.017) | 0.784 | | |
| Surgeon-rated cooperation | 0.863 (0.680–1.095) | 0.225 | | |

**Note**: *P < 0.05, considered statistically significant.

**Abbreviations**: IVI, intravitreal injection; wAMD, wet age-related macular degeneration; DME, diabetic macular edema; RVO, retinal vein occlusion; PM-CNV, myopic choroidal neovascularization; SCH, subconjunctival hemorrhage; HR, heart rate.

## Discussion

In this randomized prospective study, we found that viewing educational video prior to IVI reduced the incidence of SCH by approximately 20% in treatment-naïve patients. Patients who watched the video also reported that it was helpful in understanding the procedure and alleviating anxiety.

SCH, resulting from bleeding of conjunctival and/or episcleral vessels, is the most common complication of IVI. Although it is generally self-limiting, does not affect vision, and resolves without treatment, SCH is often distressing to patients, particularly due to its cosmetic appearance, and may lead to unnecessary emergency visits. While surgeons typically select injection sites to avoid large conjunctival and episcleral vessels, patient-related factors may also play a role in the development of SCH. Subtle behavioral responses during the procedure, such as involuntary eye movement, eyelid squeezing, or increased periocular muscle tension, may affect injection stability and vessel injury risk.

In the present study, no significant differences were observed between groups in heart rate during injection, procedure time, surgeon-rated cooperation, or patient-reported pain score. However, patients in the video group reported better understanding of the procedure. It is therefore possible that improved familiarity with the procedure may have reduced unmeasured behavioral responses that were not fully captured by the recorded parameters, which could partly explain the lower incidence of SCH. Although the difference in SCH area did not reach statistical significance, patients in the video group tended to have smaller hemorrhage areas, which may be clinically relevant in terms of reduced cosmetic impact

and improved patient acceptance, as smaller hemorrhages are generally less noticeable and may resolve more quickly. Reducing visible complications such as SCH may also improve patients' confidence in the procedure and facilitate adherence to repeated long-term treatment regimens.

Factors associated with SCH included a history of hypertension and the use of anticoagulant medications. However, hypertension did not remain significant in the multivariable analysis after adjusting other factors. This finding differs from a previous report identifying hypertension as a major risk factor for SCH after IVI.[17] One possible explanation relates to transient physiological response during the procedure. The above mentioned study has showed that elevation of mean arterial pressure during IVI, potentially triggered by anxiety and stress, was independently correlated with SCH occurrence. Acute increases in blood pressure could contribute to vessel fragility or rupture at the injection site, particularly in patients with underlying vascular vulnerability. In our study, blood pressure was not measured during the procedure; therefore, we were unable evaluate whether educational video viewing influenced hemodynamic responses or whether blood pressure fluctuations contributed to SCH occurrence. This represents an important limitation and warrants further investigation in future studies incorporating real-time physiological monitoring. Previous studies have shown that the risk of severe intraocular hemorrhage complications, excluding SCH, is extremely low in systemically anticoagulated patients.[18,19] Our study demonstrated a positive association between anticoagulant use and SCH.

The concept of this study arose from our daily clinical experience. We observed that patients receiving IVI for the first time were often highly anxious and worried about their ability to cooperate. We observed occasional cases of poor cooperation in the control group, which, although rare, may result in a traumatizing experience. However, many patients subsequently expressed surprise at how quick and tolerable the injection was, reporting that they would have felt less fearful if they had known the procedure was so simple. Previous research has also demonstrated this phenomenon, showing that treatment-naïve patients are generally more anxious compared with treatment-experienced patients.[20] To minimize confounding from prior ocular surgical experiences, we excluded patients with a history of intraocular surgeries, such as phacoemulsification or vitrectomy. In our cohort, post-video anxiety scores were not significantly lower than pre-video scores, although patients generally reported that the video was helpful in relieving their anxiety. Anticipation of the injection itself remained a major source of anxiety, which was largely alleviated after the procedure regardless of video exposure. This finding is consistent with a previous study demonstrating that electronic educational webpage viewing about the IVI process may be ineffective in reducing procedure-induced anxiety.[20]

Interestingly, comprehension of the video content was not associated with age or education level, suggesting that this video is a user-friendly tool accessible to a wide range of patients. However, comprehension score of the video was self-reported, and we did not design objective assessments to evaluate actual knowledge acquisition. No significant difference in pain scores was observed between the two groups, with both averaging around 3, a level that is generally well-tolerated by adults.

Compared to prescribing additional topical medications, which may add unnecessary cost and risk ocular surface irritation, video education is a cost-effective, patient-friendly intervention. While other approaches, such as listening to music, have been shown to reduce anxiety in medical procedures,[15,16] IVI is a brief intervention that requires clear communication among medical staffs and patients for "time-out" verification, making music less practical in this setting.

Although we incorporated objective metrics such as heart rate and procedure time to complement subjective ratings, these parameters may still be influenced by unmeasured confounders, including patients' baseline heart rate, Valsalva maneuvers, or surgeons' operating habits. Blood pressure was not measured during the procedure, which limits our ability to evaluate the potential role of hemodynamic fluctuations in the development of SCH. This was a single-center study that included only treatment-naïve patients. The population was intentionally selected, as first-time patients may experience greater uncertainty and less optimal cooperation during the procedure, potentially increasing the risk of SCH. However, this design may limit the generalizability of our findings to patients with prior IVI experience and to other clinical settings. In addition, one participant in the control group was excluded after randomization due to significant anxiety during the procedure, which resulted in prolonged procedure time and inability to complete the intervention according to protocol. This post-randomization exclusion may introduce potential bias and should be interpreted with caution. Furthermore, the final sample size was smaller than originally projected. During data collection, an interim assessment was performed for monitoring purposes, and the observed treatment difference between groups was greater

than initially anticipated. A post-hoc power was 82.6%; however, this should be interpreted with caution and is presented only as supplementary information rather than a basis for decision making. Based on the observed effect size and the consistent trend during recruitment, further enrollment was discontinued. The study procedures also involved additional assessments beyond routine care, including questionnaire administration and anterior segment photography, which required extra staff support and workflow adjustments. Nevertheless, early termination was not pre-specified in the study design and may introduce bias and potential overestimation of the treatment effect. Overall, these limitations should be considered when interpreting the findings.

## Conclusion

This single-center study demonstrates that pre-procedure educational video viewing can improve the first-time IVI experience by reducing SCH incidence and enhancing patient confidence and understanding. Given its simplicity, low cost, and ease of implementation, this approach may serve as a practical adjunct to improve both patient experience and procedural quality in clinical practice.

## Data Sharing Statement

De-identified data can be obtained from the corresponding author upon reasonable request.

## Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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## Disclosure

The authors report no conflicts of interest in this work.

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