Impact of pupil size upon the quality of vision in patients implanted with an implantable collamer lens (ICL V4c): A pilot study

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Research Article

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**Abstract**

**Objective:** This study aimed to assess the influence of pupil size on subjective visual quality in subjects with implanted collamer lenses (ICLs).

**Methods:** This retrospective study assessed eyes implanted with ICL (V4c) and categorized them into incremental groups according to pupil size. Preoperative and postoperative photopic and mesopic pupil size, uncorrected distance visual acuity (UDVA), and quality of vision (QoV) questionnaire score were assessed and compared.

**Results:** Post-operatively at 3-months the mean QoV score for day and night was 9.34 ± 0.76 and 8.58 ± 1.29 respectively. The mean mesopic pupil size (MPS) and mean photopic pupil size (PPS) was 6.59 ± 0.79 mm and 4.61 ± 0.74 mm respectively. PPS negatively correlated with “QoV day” (R_s = -0.413, P=0.001), positively correlated with “haloes” (R_s = 0.568*, P<0.001) and “blurred vision” (R_s = 0.243, P = 0.04) respectively. MPS negatively correlated with “QoV night” (R_s = -0.426, P=0.001), positively correlated with “haloes” (R_s = 0.624*, P< 0.001), “starburst” (R_s = 0.233, P=0.046) and “difficulty focusing” (R_s = 0.27, P = 0.025) respectively.

**Conclusion:** The findings of this study suggest that increasing pupil size has a negative correlation on the subjective visual quality (QoV) for day and night scores. Smaller pupil size had better QoV night scores suggesting further investigation is needed.

**Summary**

- While visual acuity following ICL implantation has been found to be effective, predictable, and safe for myopic correction, it has been reported that a minority of patients experience visual symptoms such as glare and halo.
- The relevance and impact of pupil size on post-operative quality of vision have been documented in other refractive surgeries such as SMILE, LASIK and multifocal IOL.
- The influence of pupil size upon post-operative quality of vision in ICL implanted patients has not been explored.
- The findings suggest that increasing pupil size has a negative correlation on the subjective visual quality (QoV) for day and night scores.

**1. Introduction**

Implantable collamer lens (ICL V4 and V4c; STAAR Surgical Company, Monrovia, CA, USA) are posterior chamber intraocular lens that have become a popular alternative for correcting moderate to high myopia and astigmatism [1]. The benefit of implanting ICL is that it allows stable refractive correction for patients[2, 3] and can be removed, replaced, or rotated if the outcome of the surgery is not desirable[4, 5] While the safety, efficacy, and stability of ICL for treating myopia and astigmatism has been reported and confirmed [1, 6, 7], procedures such as IOL and ICL implantation [14, 15] have been found to decrease both mesopic and photopic pupil size [11–14]. The relevance and impact of pupil size on post-operative quality of vision have been documented in refractive surgeries [6–9]. Although several studies have assessed subjective and objective quality of vision in patients following ICL (V4 and V4c) surgery [10–13], the influence of pupil size upon post-operative quality of vision has not been explored, therefore the purpose of this study was to assess the impact of postoperative pupil size upon the quality of vision following ICL (V4c) implantation.

**2. Methods**
2.1 Study Design and Objectives:

This study was conducted in compliance with the tenets of the Declaration of Helsinki and the Institutional Review Board. Participants that undergone ICL (V4c) surgery were randomly chosen from the central hospital digital register management system and one eye of each patient was evaluated in this study. All the patients had undergone ICL implantation from June 1st, 2021, to September 1st, 2021.

2.2 Criteria for inclusion and exclusion:

The inclusion criteria for the study were as follows: age ≥ 18 years old, refractive error stable for more than two years, corrected distance visual acuity (CDVA) ≥ 0.4 (before surgery), endothelium cell count (ECC) ≥ 2200 cells/mm$^2$, anterior chamber depth (ACD) > 2.8mm, intraocular pressure (IOP) within 10 to 21 mmHg, no soft contact lens wearing history for at least two weeks, no rigid gas-permeable contact lens wearing history for at least three weeks. The study excluded patients diagnosed with mild to severe dry eye, cataract, glaucoma, uveitis, retinal detachment, trauma, ocular media opacity, megalocornea, microcornea, pregnancy, autoimmune disease, diabetes, high blood pressure, and other systemic disease, mental disease, and cognitive disorder.

2.3 Pre-surgery assessment:

All patients had a comprehensive ocular examination before surgery including uncorrected logarithm of the minimum angle of resolution (logMAR) measurement and uncorrected distance visual acuity (UDVA). Additional tests included, autorefraction (OPD-Scan III, Nidek Co., Ltd, Japan), subjective refraction, slitlamp examination, tonometry, dilated fundoscopy and partial coherence interferometry (IOL- Master, Carl Zeiss Meditec AG), pupil diameter (OPD-Scan III, Nidek Co., Ltd.) with the aberrometer’s pupil-scanning component, corneal endothelial cell density (ECD) (Topcon SP-2000P, Topcon Medical Systems Inc., Japan), axial length, white to white (IOL- Master, Carl Zeiss Meditec AG), optical coherence tomography (OCT) (Cirrus HD-OCT 5000, Carl Zeiss Meditec AG), anterior chamber depth and sulcus to sulcus distance was measured using ultrasound biomicroscope (UMB) (MD-300L, China).

2.4 Surgical procedure

Levofloxacin eye drops (Santen, Osaka, Japan), Bromfenac Sodium Hydrate ophthalmic solution (Senju, Osaka, Japan) and sodium hyaluronate eye drops (URSA Pharma, Arzneimittel, GmbH) was applied six times, twice and four times per day respectively for at least 3 days before surgery. All the surgeries were performed by an experienced surgeon and followed the standard surgical procedure. One hour before the surgery, tropicamide phenylephrine eye drops (Mydrin-P, Santen, Japan) were applied to make sure the pupil was optimally dilated for surgery. Normal sterilization and anesthesia were applied before surgery. ICL was loaded into a special syringe, an incision was made at the 12 o’clock location using a stab knife, viscoelastic was injected into anterior chamber, then the ICL (V4c) was slowly implanted into posterior chamber with the syringe. The positioning of the ICL was manipulated if it was necessary, finally, viscoelastic was replaced with balanced saline solution. After surgery, antibiotics eye drops, non-steroidal anti-inflammatory eye drops (Senju, Osaka, Japan), steroidal eye drops (Santen, Osaka, Japan), and sodium hyaluronate eye drops (URSA Pharma, Arzneimittel, GmbH) were used.

2.5 Pupil assessment

All mesopic pupil size (MPS) and photopic pupil size (PPS) were assessed by OPD Scan III moreover all examinations were performed by the same ophthalmologist in the same dark room setting (0.63 lux). All the patients were required to stay in the dark room for at least 5 minutes to adapt the dark condition before examination, then the test was performed 3 times and mean value was recorded.

2.6 Subjective quality of vision assessment
The subjective visual satisfaction of patients after ICL surgery was evaluated using a previously validated Quality of Vision (QoV) questionnaire. In order to ascertain the patient’s postoperative subjective quality of vision perception for individual eye, patients were requested to rate their quality of vision on a Likert scale of zero (0) to ten (10) for “daytime” and “nighttime” separately. A score of “0” denoted the worst quality of vision, while a score of “10” denoted the best quality of vision. In addition, the QoV questionnaire ascertained the impact, frequency and severity of certain visual phenomena which are common in postoperative refractive surgery such as (i) glare, (ii) haloes, (iii) starbursts, (iv) hazy vision, (v) blurred vision, (vi) distortion, (vii) multiple images, (viii) fluctuation in vision, (ix) focusing difficulties, (x) difficulty judging distance or depth perception on a scale of zero (0) to three (3). Zero (0) denoted: none, one (1) denoted: “a little”, two (2) denoted: “quite” and three (3) denoted: “very”.

2.7 Statistical analysis

Descriptive parameters were expressed as mean ± standard deviation. All data analysis was performed by SPSS version 26 (SPSS Inc., Chicago, IL, USA). Shapiro-Wilk test was applied to assess the normal distribution of variables. Spearman test was applied to analysis the correlation between PPS and QoV at daytime, MPS and QoV at night-time. Paired t-test was applied to analysis the difference between the pre-operative and post-operative pupil size. According to pupil size, patients were divided into 7 interval groups: A: 2.00 to 2.99 mm, B: 3.00 to 3.99 mm, C: 4.00 to 4.99 mm, D: 5.00 to 5.99 mm, E: 6.00 to 6.99 mm, F: 7.00 to 7.99 mm, G: 8.00 to 8.99 mm. ANOVA was used to find the difference of QoV at daytime and QoV at night-time in different groups. The level of statistical significance was set at $P < 0.05$.

3. Results

The mean age of the participants was 23.62 ± 4.44 years. Preoperative status of the patients was as follows: mean spherical equivalent (SE) was −7.18 ± 2.91 D, mean preoperative UDVA was 1.04 ± 0.55 LogMAR, mean CDVA was 0.01 ± 0.02, mean centre cornea thickness (CCT) was 524.35 ± 37.31 mm, mean WTW was 11.60 ± 0.38mm. Postoperative status of the patients in three months was as follows: mean UDVA was −0.10 ± 0.06 LogMAR (Table 1). Mean QoV for day and night was 9.34 ± 0.76 and 8.58 ± 1.29 respectively.
Table 1

Demographics information

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Mean ± SD</th>
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</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>23.62 ± 4.44</td>
</tr>
<tr>
<td>Sex</td>
<td>28 males (53%)/ 25 females (47%)</td>
</tr>
<tr>
<td>Pre surgery UDVA</td>
<td>1.04 ± 0.55</td>
</tr>
<tr>
<td>ACD (mm)</td>
<td>3.31 ± 0.25</td>
</tr>
<tr>
<td>SE (diopter)</td>
<td>-7.18 ± 2.91</td>
</tr>
<tr>
<td>K1 (diopter)</td>
<td>43.19 ± 1.37</td>
</tr>
<tr>
<td>K2 (diopter)</td>
<td>44.56 ± 1.36</td>
</tr>
<tr>
<td>CTT (mm)</td>
<td>524.35 ± 37.31</td>
</tr>
<tr>
<td>WTW (mm)</td>
<td>11.60 ± 0.38</td>
</tr>
<tr>
<td>IOP (mmHg)</td>
<td>13.88 ± 2.64</td>
</tr>
<tr>
<td>ICL diameter (mm)</td>
<td>13.03 ± 0.35</td>
</tr>
</tbody>
</table>


Pupil size assessment: Pre-operative mean MPS and mean PPS was 6.75 ± 0.84mm (range: 4.73mm to 9.14mm) and 4.57 ± 0.74mm (range: 2.92mm to 5.84mm) respectively. At 3-month following surgery, mean MPS and mean PPS was 6.59 ± 0.79mm (range: 4.66mm to 8.31mm) and 4.61 ± 0.74mm (range: 2.96mm to 5.86mm) respectively. Pre-operative and the post-operative MPS ($P < 0.001$, $t = 8.344$) and pre-operative and the post-operative PPS ($P < 0.001$, $t = -10.860$) were both significantly different.

Prevalence and distribution of dysphotopsia: post-operatively, dysphotopsia symptoms were assessed and the highest score that could be achieved by a patient was 9 and lowest was 0. The mean score of total glare score was 0.28 ± 1.21 (range: 0 to 6), total halo score was 2.15 ± 1.78 (range: 0 to 7), total starburst score was 0.47 ± 1.19 (range: 0 to 4), total hazy score was 0.30 ± 1.03 (range: 0 to 5), total blurred score was 0.34 ± 1.18 (range: 0 to 6), total double vision score was 0.23 ± 0.80 (range: 0 to 3), total fluctuation score was 0.09 ± 0.30 (range: 0 to 1), total focus score was 0.17 ± 0.78 (range: 0 to 5), total depth perception score was 0.08 ± 0.38 (range: 0 to 2), in this study we didn't find any patients experienced distortion (Table 2). Mean and stand deviation score of frequency, severity, and influence of visual symptoms (including glare, halo, starbursts, hazy vision, blurred vision, experience distortion, double or multiple images, focusing difficulties, depth perception) is shown in histograms of Figs. 1, 2, 3 and 4 respectively.
### Table 2
Assessment of pupil size and quality of vision questionnaire items

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean ± SD</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mesopic pupil size (mm)</td>
<td>6.59 ± 0.79</td>
<td>4.66</td>
<td>8.31</td>
</tr>
<tr>
<td>Photopic pupil size (mm)</td>
<td>4.61 ± 0.74</td>
<td>2.96</td>
<td>5.86</td>
</tr>
<tr>
<td>QoV at night (0–10)</td>
<td>8.58 ± 1.29</td>
<td>5.00</td>
<td>10.00</td>
</tr>
<tr>
<td>QoV at day (0–10)</td>
<td>9.34 ± 0.76</td>
<td>8.00</td>
<td>10.00</td>
</tr>
<tr>
<td>Total glare score (0–9)</td>
<td>0.28 ± 1.21</td>
<td>0.00</td>
<td>6.00</td>
</tr>
<tr>
<td>Total halo score (0–9)</td>
<td>2.15 ± 1.78</td>
<td>0.00</td>
<td>7.00</td>
</tr>
<tr>
<td>Total starburst (0–9)</td>
<td>0.47 ± 1.19</td>
<td>0.00</td>
<td>4.00</td>
</tr>
<tr>
<td>Total hazy score (0–9)</td>
<td>0.30 ± 1.03</td>
<td>0.00</td>
<td>5.00</td>
</tr>
<tr>
<td>Total blurred score (0–9)</td>
<td>0.34 ± 1.18</td>
<td>0.00</td>
<td>6.00</td>
</tr>
<tr>
<td>Total distortion score (0–9)</td>
<td>0.00 ± 0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Total double vision (0–9)</td>
<td>0.23 ± 0.80</td>
<td>0.00</td>
<td>3.00</td>
</tr>
<tr>
<td>Total fluctuation score (0–9)</td>
<td>0.09 ± 0.30</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Total focus score (0–9)</td>
<td>0.17 ± 0.78</td>
<td>0.00</td>
<td>5.00</td>
</tr>
<tr>
<td>Total depth perception score (0–9)</td>
<td>0.08 ± 0.38</td>
<td>0.00</td>
<td>2.00</td>
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</table>

The impact of pupil size upon QoV: MPS negatively correlated with QoV at day time ($R_s = -0.413^*, P = 0.001$) (Fig. 5). PPS negatively correlated with QoV at nighttime ($R_s = -0.426^* P = 0.001$) (Fig. 6).

Impact of pupil size upon dysphotopsia: PPS significantly correlated with “halo” ($R_s = 0.568^* P < 0.001$), and “blurred vision” ($R_s = 0.243^* P = 0.04$). However, PPS had no significant correlation with “glare” ($R_s = 0.169, P = 0.113$), “starburst” ($R_s = 0.115, P = 0.207$), “hazy vision” ($R_s = 0.115, P = 0.207$), “multiple images” ($R_s = 0.198, P = 0.077$), “fluctuation in vision” ($R_s = 0.004, P = 0.488$), “focusing difficulties” ($R_s = 0.118, P = 0.199$), “difficulty judging distance or depth perception” ($R_s = 0.181, P = 0.097$). While assessing MPS, significant correlation was found with “halo” ($R_s = 0.624^*, P < 0.001$), “starburst” ($R_s = 0.233^* P = 0.046$), and “focusing difficulties” ($R_s = 0.27^* P = 0.025$). Furthermore, MPS was found to have no significant correlation with “glare” ($R_s = 0.022, P = 0.437$), “hazy vision” ($R_s = 0.169, P = 0.114$), “blurred vision” ($R_s = 0.069, P = 0.311$), “multiple images” ($R_s = 0.226, P = 0.051$), “fluctuation in vision” ($R_s = 0.127, P = 0.183$), “difficulty judging distance or depth perception” ($R_s = 0.042, P = 0.382$). (Table 3.)
Table 3
Impact of pupil size upon dysphotopsia

<table>
<thead>
<tr>
<th>Variables</th>
<th>Total glare score</th>
<th>Total halo score</th>
<th>Total starburst score</th>
<th>Total hazy score</th>
<th>Total blur score</th>
<th>Total distortion score</th>
<th>Total double score</th>
<th>Total fluctuation score</th>
<th>Total focus score</th>
<th>Total depth score</th>
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<tbody>
<tr>
<td>Photopic (mm)</td>
<td>0.169</td>
<td>.568**</td>
<td>0.115</td>
<td>0.022</td>
<td>.243*</td>
<td>0.198</td>
<td>0.004</td>
<td>0.118</td>
<td>0.181</td>
<td></td>
</tr>
<tr>
<td>P-value</td>
<td>0.113</td>
<td>≤ 0.001</td>
<td>0.207</td>
<td>0.437</td>
<td>0.04</td>
<td>0.077</td>
<td>0.488</td>
<td>0.199</td>
<td>0.097</td>
<td></td>
</tr>
<tr>
<td>Mesopic (mm)</td>
<td>0.022</td>
<td>.624**</td>
<td>.233*</td>
<td>0.169</td>
<td>0.069</td>
<td>0.226</td>
<td>-0.127</td>
<td>.270*</td>
<td>-0.042</td>
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<tr>
<td>P-value</td>
<td>0.437</td>
<td>≤ 0.001</td>
<td>0.046</td>
<td>0.114</td>
<td>0.311</td>
<td>0.051</td>
<td>0.183</td>
<td>0.025</td>
<td>0.382</td>
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mm: millimeter; * Correlation is significant at the 0.05 level; ** Correlation is significant at the 0.01 level.

Additionally, this study compared mean QoV for and night in different incrementally increasing pupil groups. Night QoV was found to be significantly different among groups ($P = 0.02*$, $F = 3.234$), and the pupil size from 4.00 to 4.99 mm was found to achieved better mean QoV at night (mean QoV: 10 ± 0.00). While QoV at daytime was not found to be significantly different between different PPS groups. (Table 4).

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<tbody>
<tr>
<td>Mean Total QoV day score (0–10)</td>
<td>10.00</td>
<td>9.64</td>
<td>9.39</td>
<td>9.06</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.166</td>
<td>1.768</td>
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<tr>
<td>±SD</td>
<td>0.00</td>
<td>0.67</td>
<td>0.72</td>
<td>0.80</td>
<td>0.00</td>
<td>0.00</td>
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<tbody>
<tr>
<td>Mean Total QoV night score (0–10)</td>
<td>0.00</td>
<td>0.00</td>
<td>10.00</td>
<td>9.00</td>
<td>8.56</td>
<td>8.15</td>
<td>6.67</td>
<td>0.02*$</td>
<td>3.234</td>
</tr>
<tr>
<td>±SD</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.82</td>
<td>1.34</td>
<td>1.14</td>
<td>0.58</td>
<td>0.00</td>
<td>0.00</td>
</tr>
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</table>

mm: millimeter; * Correlation is significant at the 0.05 level; ** Correlation is significant at the 0.01 level.

4. Discussion
While other studies have explored the non-perforated and newer perforated (V4c) ICL models and its effect upon the subjective and objective quality of vision [14, 15], the current study aimed to explore the relationship between quality of vision and pupil size. The results indicate that larger pupil group have significantly lower quality of vision at night than smaller pupil group. Both mesopic and photopic pupil size significantly correlated with their respective overall QoV scores. Similar to Dan Li et al. and other studies [16–18], the current study found that pupil size decreased following ICL implantation, and it’s been speculated that mechanical irritation of uveal tissue by the implanted lens and surgical intervention to be responsible. Furthermore, participants with pupil size interval from 4 to 4.99 mm were found to experience better QoV.

While VA following ICL implantation has been found to be effective, predictable, and safe for myopic correction, it has been reported that a minority of patients experience visual symptoms such as glare and halo [19, 20]. Furthermore, visual symptoms have also been reported to decrease and stabilize over time [15]. As reported by Leong et al. [21] visual symptoms following ICL implantation (at 3-month operative assessment) have been implicated to negatively affect the quality of life (QoL) of otherwise highly satisfied patients (58%: very satisfied and 37%: satisfied) [21]. A perfect optical system would render an object with no loss of contrast or resolution onto the retina, however, the eye is not a flawless optical apparatus. Primary causes of retinal picture degradation are due to diffraction, aberrations, and scatter [22]. While diffraction is clinically significant for small pupil sizes (3 mm), aberrations and scatter (stray light) tend to impact the quality of vision, in pupils with greater diameter [23]. Following laser refractive surgery, HOA may result in visual symptoms such as glare and halos, as well as diminished vision quality [24]. Wavefront-guided therapy for HOA caused by refractive surgery has been proven to boost patient satisfaction, since the decrease in HOA leads in fewer night-vision complaints postoperatively [25, 26]. Pupil size is the primary factor which influences HOA and has a significant impact on retina image.

Since the mechanism of dysphotopsia is multifactorial, and complete prevention is relatively impossible with our current technology. This study shows that pupil size is negatively correlated with QoV day and QoV night, implying that the larger the pupil, the worse the quality of vision. PPS was found to positively correlated with halo and blurred vision, while MPS was found to positively correlated with halo, starburst and focusing difficulties. The comparison of QoV in different pupil groups revealed that there is a significant difference between MPS groups. However, no significance difference between the mean QoV scores was found in PPS groups. This opposing finding between the mesopic and photopic group implies that pupils have a greater and significant influence during night vision. Pupil diameter has a greater effect on visual symptoms at night, and larger pupil results in a lower visual quality. As a result, pupil diameter is a critical parameter to consider prior to ICL implantation. Patients especially with larger pupil at night (mesopic pupil size), should be cautioned prior to surgery of dysphotopsia at low light conditions. In this study, the investigation of questionnaire revealed that dysphotopsia had little impact on life for majority of patients. Keuch et al. [17] reported a reduction in pupil two weeks following posterior chamber intraocular lens implantation (ICL). This result may be explained by the vault of ICL, which may mechanically stimulate pupil constriction and dilatation. Therefore, the reduction of pupil size after ICL may be beneficial for patients to some extent, as smaller pupil could help the patient achieve better QoV with lower dysphotopsia scores after surgery.

The limitations of this study are as follows: QoV questionnaire was not assessed pre-operatively and postoperatively at various follow-ups, this would have allowed for a comprehensive analysis of visual neuroadaptation. Moreover, the larger sample size would bolster the findings of this study. Finally, the relationship between pupil size and optic zone of the ICL was not explored since the retrospective records did not include this information.

5. Conclusion
The findings of this study suggest that increasing pupil size of the patients who underwent ICL has a negative correlation on their subjective visual quality (QoV) during the day and night. Smaller pupil size during the night had significantly better night QoV score. Furthermore, the group with pupil size ranging from 4 to 4.99 mm has the best QoV score for night.

**Declarations**

**ETHICS APPROVAL AND CONSENT TO PARTICIPATE**

The study was registered with the trial number NCT04982107, and was conducted in compliance with the tenets of the Declaration of Helsinki and the Institutional Review Board of the He Eye Specialist Hospital, Shenyang, China (IRB(2020)K028.01). Documented informed consent was obtained from all participants in this study. In the present study, all components with any individually identifiable information have been removed in the dataset, which classifies it can be used as non-human subjects’ research.

**CONSENT FOR PUBLICATION**

Not Applicable.

**AVAILABILITY OF DATA AND MATERIALS**

Anonymized datasets generated and analyzed during the current study will be made available on reasonable request by the corresponding author (Emmanuel Eric Pazo, ericpazo@outlook.com)

**COMPETING INTERESTS**

None

**FUNDING**

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**AUTHORS’ CONTRIBUTIONS (THIS STATEMENT MUST EXACTLY MATCH ON EDITORIAL SUBMISSION SYSTEM AND IN THE MANUSCRIPT)**

Conception and design of the research: QZ, HH, YW, GQ, LL, JC, HC, TY, SY, CY, LX, JEM, WH, EEP and XH; Analysis and interpretation of the data: QZ, GQ, EEP; Writing original draft preparation: QZ; Critical revision of the manuscript: review and editing: QZ and EEP; Supervision: XH, SY and EEP.

**ACKNOWLEDGEMENTS**

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**AUTHORS’ INFORMATION**

Not Applicable.

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**Figures**
Figure 1

Total visual symptom score

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Mean Score</th>
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<tbody>
<tr>
<td>Glare</td>
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<tr>
<td>Halo</td>
<td>2.15</td>
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<tr>
<td>Starburst</td>
<td>0.47</td>
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<tr>
<td>Hazy</td>
<td>0.30</td>
</tr>
<tr>
<td>Blur</td>
<td>0.34</td>
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<tr>
<td>Distortion</td>
<td>0.00</td>
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<tr>
<td>Double</td>
<td>0.23</td>
</tr>
<tr>
<td>Fluctuation</td>
<td>0.09</td>
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<tr>
<td>Focus</td>
<td>0.17</td>
</tr>
<tr>
<td>Depth</td>
<td>0.08</td>
</tr>
</tbody>
</table>
Figure 2

Frequency of visual symptom score
Figure 3

Severity of visual symptom score
Figure 4

Influence of visual symptom score
Figure 5

Figure legend not available with this version.
Figure 6

Figure legend not available with this version.