

Research Article

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Evaluation of Antiglaucoma Eyedrop Administration Techniques Among Glaucoma Patients at Mongolia Japan Hospital: A Hospital Based Cross Sectional Study

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Received: June 10, 2026; **Accepted:** June 15, 2026; **Published:** June 24, 2026

Background

Globally, 2.2 billion people suffer from distance and near vision impairment, of which 1 billion approximately half have vision loss that could have been prevented. The causes of this preventable vision loss include cataracts (94 million), refractive errors (88.4 million), age-related macular degeneration (8 million), glaucoma (7.7 million), and diabetic retinopathy (3.9 million) [1]. Glaucoma is a group of disease caused by various factors that result in optic nerve degeneration due to the loss of retinal ganglion cells. Approximately 70 million people worldwide are affected by glaucoma, and more than 10% of them experience blindness or low vision [2]. This condition is a significant public health issue, ranking second only to cataracts as a cause of irreversible vision loss, and it greatly diminishes quality of life [3]. The economic burden on patients increases with the number of eye drops required to reduce Intraocular Pressure (IOP), and this burden grows as the disease progresses [4]. According to Raghav et al., 9 out of 10 glaucoma patients used proper drop instillation technique, and the effectiveness of treatment was found to be directly dependent on the method of eye drop administration [5].

The success of glaucoma medication therapy depends on administering IOP-lowering drops at the correct time, in the correct dosage, and using the correct technique. Although recent studies have focused more on the effectiveness of these medications, very few have evaluated the proper technique for administering eye drops. This lack of research forms the basis for our current study.

Purpose

To evaluate the eye drop instillation technique among patients diagnosed with glaucoma who use antiglaucoma eye drops.

Methods

Study Design

This hospital-based cross-sectional observational study was conducted at the Mongolia-Japan Hospital of MNUMS from January to March 2025. The study protocol was reviewed and approved by the Clinical Research Subcommittee of the Mongolia-

Japan Hospital, and informed consent was obtained from all participants. Patients attending the ophthalmology outpatient clinic who had been diagnosed with glaucoma for more than 6 months, were over the age of 35, had primary open-angle glaucoma or primary angle-closure glaucoma (treated with laser iridotomy), were self-administering their eye drops, and had been using intraocular pressure-lowering drops for more than 6 months, and who gave consent to participate, were included in the study. Patients with secondary open-angle or closed-angle glaucoma, or those who were unable to self-administer drops due to tremor or other physical impairments, were excluded from the study.

Materials and Methods

- Sample Population: Questionnaires with both objective and subjective evaluations were administered to patients diagnosed with primary and secondary glaucoma who were attending the ophthalmology outpatient clinic at the Mongolia-Japan Hospital.
- The first part of the questionnaire included general questions such as the patient's age and gender, intraocular pressure measurements (using the KT-800 Non-Contact Kowa tonometer), the duration since glaucoma diagnosis, and the current IOP-lowering eye drops being used. Part B assessed the eye drop instillation technique using objective evaluation. Participants were instructed to instill artificial tears (Tear Naturale II by Alcon, containing Hypromellose 3 mg/ml and Dextran 1 mg/ml) in one eye at home, using the same technique they would use for their IOP-lowering medication. To minimize errors in data collection, a single researcher observed and evaluated the eye drop instillation technique using a structured objective evaluation form. Standard parameters for proper drop instillation were included in the form, and each correct technique was awarded one point. A score of 6 or more out of 12 was considered a satisfactory technique. Part C (subjective questionnaire) assessed factors such as instillation posture, consistency of drop use, time intervals between installations, and whether patients had received instruction on the correct technique. (See Appendix 1)

Inclusion and Exclusion Criteria

Inclusion Criteria

- Age 35 years or older
- Uncorrected distance visual acuity of 6/60 or better
- Ability to self-administer eye drops
- Diagnosed with primary open-angle glaucoma
- Diagnosed with primary angle-closure glaucoma and treated with laser iridotomy
- Has been using IOP-lowering eye drops for 6 months or more
- Able to complete the questionnaire

Exclusion Criteria

- Age under 35 years
- Uncorrected distance visual acuity worse than 6/60
- Diagnosed with glaucoma for less than 6 months
- Using IOP-lowering eye drops for less than 6 months
- Ocular pathology causing media opacity (e.g., corneal opacity, moderate to severe cataract)
- Inability to self-administer eye drops due to tremor or other physical disabilities
- Refusal to participate in the study

Statistical Analysis

Calculations were performed using Microsoft Excel and STATA software. Quantitative data were expressed as mean and standard deviation, while qualitative data were presented as percentages. The relationship between two groups was evaluated using the Chi-square test. A p-value of less than 0.05 was considered statistically significant.

Study Result

A total of 34 patients aged between 38 and 77 years participated in the study. Among them, 23.5% (8) were male and 76.5% (26) were female. The overall mean age was 64.11 ± 7.86 years (male mean age: 67.25 ± 2.21 ; female mean age: 63.15 ± 1.60). The mean intraocular pressure (IOP) was 15.56 ± 5.41 mmHg in the right eye and 16.49 ± 6.97 mmHg in the left eye. Regarding the duration of using IOP-lowering eye drops: 1 patients (32.35%) had been using drops for 6 months to 1 year, 7 patients (20.59%) for 1–2 years, 10 patients (29.41%) for 2–5 years, and 6 patients (17.65%) for more than 5 years. Additionally, 20.59% (7) of participants stored their eye drops in cool conditions, while 79.41% (27) stored them under normal room conditions.

Objective Evaluation

Among the study participants, 23.5% (8) washed their hands before instilling the eye drops, 76.47% (26) performed the procedure in a sitting position, and 82.35% tilted their heads slightly backward during instillation. A total of 94.11% (32) were able to successfully instill at least one drop into the eye.

However, 61.76% (21) allowed the tip of the dropper to touch other parts of the eye, such as the eyelids or conjunctiva during installation. Only 11.76% (4) pressed on the nasolacrimal duct after instillation, and 23.52% (8) repeated the instillation after the first attempt.

Each item on the objective evaluation checklist was scored from 0 to 1, and patients who scored 6 or more out of a possible 12 points were considered to have a satisfactory eye drop instillation technique. In our study, 64.70% (22) of participants demonstrated a satisfactory technique. When comparing the technique scores between groups based on educational background, there was no statistically significant difference observed ($p = 0.097$).

Subjective Evaluation

Among the participants, 70.59% (24) reported that they do not wash their hands before instilling eye drops, while 29.41% (10) said they do.

A total of 94.12% (32) checked the eye drops before using them, and the same percentage (94.12%, or 32 participants) repeated the instillation after the initial application. About 64.71% (22) administered their pressure-lowering eye drops at a consistent time each day, whereas 35.29% (12) were unable to maintain a regular schedule. In terms of forgetfulness, 44.12% (15) admitted to forgetting the time to instill their eye drops, while the remaining 55.88% (19) stated they administered the drops regularly. Regarding the number of medications used: 58.82% (20) used one class of pressure-lowering eye drops, 35.29% (12) used two classes, 5.88% (2) used three different classes of eye drops.

Conclusion

The normal tear film volume is approximately 7–10 μ L, which increases to about 25 μ L during gentle blinking. However, the average volume of a single drop from a standard eye drop bottle is about 50 μ L, which exceeds the eye's conjunctival sac capacity, resulting in overflow [6].

In a study by 21% of patients who self-administered intraocular pressure (IOP)-lowering drops applied two or more drops to the eye. Similarly, in our study, 23.52% (8) of participants reported instilling drops more than once. This results in wastage of excess medication, as the overflowed drops either run down the cheek or enter the nasolacrimal system, increasing systemic absorption and potential side effects. Moreover, incorrect application reduces corneal absorption and, consequently, the therapeutic efficacy of the medication.

Improper technique not only lowers treatment outcomes but may necessitate more frequent or higher-dose administration to achieve target IOP, leading to an increased risk of side effects and added economic burden for patients.

Medications absorbed systemically through the nasolacrimal duct bypass hepatic metabolism and may thus have more severe systemic effects [7]. Pressing on the nasolacrimal duct or gently closing the eyes after instillation can significantly enhance ocular bioavailability and reduce systemic absorption [8,9]. Despite this, 88.24% (28) of our participants did not press on the nasolacrimal duct after instilling drops, increasing the risk of both local and systemic side effects. Common IOP-lowering medications, especially beta-blockers, may cause cardiac arrhythmias, heart failure, or respiratory issues, while carbonic anhydrase inhibitors can lead to thrombocytopenia or electrolyte imbalance. Therefore, using proper instillation technique is critically important to minimize such risks [10]. It has been shown that pressing on the nasolacrimal duct after drop instillation can reduce systemic absorption by up to 60% [10].

Accidental contact of the dropper tip with the eye area can mechanically damage the cornea [6]. In our study, 61.76% (21) of participants reported that the dropper tip touched the eyelid or conjunctiva during use, which is about 1.6 times higher than the 37.17% reported in the study by [11].

Improperly administered drops not only reduce treatment efficacy but also lead to faster depletion of medication, requiring more frequent purchases and increasing emotional and financial burden on patients [12].

In our study, only 20.59% (7) of participants received proper instruction on drop instillation technique from a doctor or nurse. The remaining 79.41% (27) did not receive adequate guidance. Of all participants, 34% learned the technique from brochures or printed materials, while 21% were shown the method directly by a physician.

Discussion

From this study, it can be seen that the majority of participants (64.70%, n=22) had an adequate technique for administering eye drops. However, many participants were observed not to wash their hands before applying the drops, to touch other parts of the eye during instillation, and not to press on the lacrimal punctum after applying the drops. It is also important for doctors and nurses to explain and demonstrate the correct eye drop administration technique to all patients diagnosed with glaucoma and those requiring eye drops. Teaching the proper method to patients who are using drops incorrectly can help reduce surface damage to the eye, prevent infections transmitted by the drops, minimize ineffective medication use and unnecessary expenses, and reduce both local and systemic side effects on the eye.

In our study, participants were able to successfully instill at least one drop, but most patients had not fully mastered the correct technique. Common mistakes included storing drops in usual home conditions, not disinfecting or washing hands before instilling drops, not pressing on the lacrimal punctum after application, touching the dropper tip to the eyelid or other parts of the eye, and instilling two drops at once.

Training patients in the correct technique for administering eye drops can improve the effectiveness of treatment and reduce the economic burden on patients to a certain extent.

Novelty of the Study

This study has the advantage of being the first to evaluate both objectively and subjectively the eye drop instillation technique among patients diagnosed with glaucoma. It serves as a primary study that can provide the foundation for future similar research.

Limitations

The study was conducted over a short period. It focused on the correct use of intraocular pressure-lowering eye drops among patients diagnosed with glaucoma, but it did not evaluate local or systemic side effects related to improper use of eye drops.

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