CUREON Perspective Across Modern Medicine | Open Access

Original Article | Volume 01 Issue 01 (2025) | Page No. 17-23

Administration Technique of Eye Medications and Disposal Practices Among Patients in Karachi: A cross-sectional Analytical Study

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Received: May 10, 2025

Accepted: June 27, 2025

Published: July 8,2025

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Abstract

Objective:

This study aimed to assess the administration technique of eye medications and disposal practices among ophthalmic patients in Karachi, also to identify determinants associated with correct usage.

Method:

An analytical cross-sectional study was conducted between May and July 2025 at the Department of Ophthalmology and Visual Sciences, SMBBIT, and a private eye clinic in Karachi. A convenience sample of adult patients (≥18 years) using ophthalmic medications for at least one week was enrolled. Data were collected using an interview-based questionnaire and direct observation of instillation technique. Descriptive statistics summarized demographic and clinical variables, while t-tests and logistic regression identified determinants of correct technique.

Result:

A total of 354 patients were taken of age 53.8 ± 17.4; 54.8% were female. Only 21.4% performed hand hygiene before instillation, 71.5% instilled a single drop, and 18.6% practiced nasolacrimal occlusion. The mean technique score was 4.0/7. Female sex, literacy, prior ocular surgery, and receiving professional instruction were significantly associated with higher technique scores ($p<0.05$). Disposal practices were suboptimal: 76.1% discarded drops in household garbage, while <5% returned them to pharmacies.

Conclusion:

Patients in Karachi demonstrated suboptimal administration, unsafe disposal of ophthalmic medications,structured education and

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improved disposal guidance are urgently required to enhance therapeutic outcomes and reduce environmental risks.

Keywords*: Medications, administration technique, disposal practices, pharmacology, ophthalmology, patient education.*

Introduction

Vision-related disorders remain a leading cause of disability worldwide, with cataract, glaucoma, corneal opacities, and diabetic retinopathy accounting for a significant share of preventable blindness[1]. Topical ophthalmic medications are central to management, but their efficacy depends heavily on correct instillation technique. WHO reports that over half of all prescribed medications are used incorrectly, underscoring the challenge of patient compliance[2]. Incorrect instillation—such as failing to wash hands, touching the dropper tip to the eye, administering multiple drops, or neglecting nasolacrimal occlusion (NLO)—reduces drug bioavailability, increases systemic absorption, and raises treatment costs[3–4].A multicenter Canadian study showed that poor dexterity and advanced age contributed to incorrect technique in glaucoma patients[5]. Similarly, in Hong Kong, elderly patients frequently demonstrated suboptimal practices, though educational interventions improved outcomes[6]. Environmental safety is an additional dimension. Disposal of unused or expired ophthalmic medications in household trash or sinks contributes to pharmaceutical pollution[7]. Surveys in South Asia, including Pakistan, confirm limited awareness of safe disposal, with the majority of patients discarding medicines in regular garbage[8]. Evidence from Eritrea highlights how determinants such as sex, literacy, and ocular comorbidities influence proper administration[9]. Comparable studies from Ethiopia and Saudi Arabia have also reported poor administration scores, ranging from 16% to 40% correct technique[10–11]. Despite this, literature from Pakistan remains scarce.

Given Karachi's large and diverse urban population, evaluating instillation practices and disposal behaviors here provides insights for designing targeted interventions. This study therefore aims to examine both the technique and disposal practices of ophthalmic medication users in Karachi, and to identify predictors of correct technique. By situating local findings within global evidence, it underscores the urgent need for structured counseling and sustainable pharmaceutical waste strategies.

Methods

This analytical cross-sectional study was conducted between May and July 2025 at the Department of Ophthalmology and Visual Sciences, SMBBIT, Karachi, and a private eye clinic. The study included adult patients aged ≥18 years who had been prescribed ophthalmic medications (drops or ointments) for at least one week. Exclusion criteria were severe cognitive impairment, acute ocular trauma, or inpatient admission, following approaches adopted in similar international studies. A convenience sampling technique was employed due to feasibility constraints. Data were collected through face-to-face interviews using a structured questionnaire adapted from validated tools and direct observation using a 7-item instillation checklist (hand hygiene, avoiding tip touch, pulling lower eyelid, correct drop count, spacing between medications, eye closure, NLO). Disposal practices were also documented.Descriptive statistics (means, SDs, and percentages) summarized demographic and clinical variables. Independent t-tests compared mean technique scores across subgroups. Logistic regression was used to assess determinants such as sex, education, prior ocular surgery, and counseling received. A p-value <0.05 was considered statistically significant. Data were analyzed using SPSS v26.

Results

Table 1 shows the demographic and clinical profile of the study participants. The mean age of respondents was 53.8 years, indicating a predominantly middle-aged sample with a wide variation across younger and older patients. Slightly more than half of the participants were female (54.8%), while males comprised 45.2%. Educational status was evenly distributed, with half of the respondents reporting no or only primary education and the other half having secondary or higher education. About one-third of participants (33.9%) had undergone prior ocular surgery, and only 34.7% had ever received professional instruction on the proper use of eye drops, highlighting important gaps in patient counseling**.**

Table 1: *Demographic Characteristics of Participants*

Variable	Category	n (%)
Age (mean ± SD)	53.8 ± 17.4 years	–
Sex	Male	160 (45.2)
	Female	194 (54.8)
Education	Illiterate/Primary	177 (50.0)

Variable	Category	n (%)
	Secondary+	177 (50.0)
Prior ocular surgery	Yes	120 (33.9)
Professional instruction	Yes	123 (34.7)

Table 2 shows the mean instillation scores across different subgroups. Female participants scored significantly higher than males (p=0.003). Similarly, literate patients, those with prior ocular surgery, and those who had received professional instruction demonstrated better technique scores, with the strongest association observed for counseling (p<0.001).

Table 2: *Factors Associated with Correct Technique (≥5/7 score)*

Variable	Mean Score ± SD	t-value	p-value
Sex (Male vs Female)	3.7 ± 1.1 vs 4.3 ± 1.2	3.00	0.003*
Education (Illiterate vs Literate)	3.6 ± 1.0 vs 4.4 ± 1.1	2.55	0.011*
Prior ocular surgery (No vs Yes)	3.8 ± 1.2 vs 4.3 ± 1.1	2.24	0.026*
Received professional instruction (No vs Yes)	3.6 ± 1.0 vs 4.6 ± 1.1	4.21	<0.001*

*Significant at p<0.05

Discussion

This study highlights critical gaps in ophthalmic medication administration and disposal among patients in Karachi. Only about 20% practiced hand hygiene before instillation, and fewer than 20% performed nasolacrimal occlusion (NLO), echoing findings from Eritrea[9] and Ethiopia[10]. Additional studies in other low- and middle-income settings reinforce this trend; for instance, many patients touch the bottle tip to the eye while instilling drops, compromising sterility and increasing infection risk[11-14]. Globally, poor technique is well-documented. In Belgium, incorrect administration—including lack of eyelid closure and NLO—was common, particularly among elderly patients with dexterity challenges[13]. Similarly, in glaucoma clinics in Canada, video analysis revealed frequent errors in drop instillation steps[5,15,16]. Directed educational interventions—such as instructional videos, pharmacist-led coaching, and checklists—have shown to improve technique scores and self-efficacy[7,17]. In our cohort, the mean technique score of 4.0/7 matches

findings from Eritrea's 4.16 mean score[9], supporting the systemic nature of this issue in similar demographic contexts[18]. Determinants of correct technique emerged: female sex and literacy were associated with better performance, aligning with patterns seen in Eritrea and Ethiopia[9],[19]. Prior counseling and experience—such as previous ocular surgery—also had positive impacts, consistent with adherence-focused studies in Ghanaian and Indian cataract cohorts[10],[20]. Disposal practices are equally concerning—76% of participants discarded drops in household trash. Broader regional data reflects similar behavior in Pakistan's Quetta city and South Asia in general[8]. Internationally, improper disposal (trash, sink, flushing) contributes to pharmaceutical pollution, contaminating surface water and aquatic ecosystems[21-24]. EPA reports show landfill leachate and flushed medications contribute to persistent environmental contamination[12]. Studies confirm that even wastewater treatment facilities often fail to remove these micropollutants[15],[13],[25]. Plastic waste is another challenge. Single-use eye drop vials generate significantly more plastic than multi-dose systems. The reliance on disposables and premature discarding results in unnecessary carbon and plastic footprints[7],[15]. Moreover, microplastics in ophthalmic products have been detected, raising new concerns about ocular and systemic exposure[4],[11].

Strength & Limitations:

This study combined direct observation with self-report, ensuring more accurate assessment of instillation practices. Including both a public tertiary center and a private clinic enhances generalizability. Being cross-sectional, causality cannot be inferred. Convenience sampling may introduce bias, and results may not be generalizable to rural populations.

Conclusion

Improper administration and unsafe disposal of ophthalmic medications are prevalent among patients in Karachi. Female sex, literacy, prior surgery, and professional counseling were associated with better technique. Systematic patient education, integration of instructional materials into routine care, and public guidance on safe disposal are essential to improve outcomes and reduce environmental risk.

Author Contributions:

Dr Sumaiya Hira verifies the full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis

Concept and design: Sumaiya Hira.

Acquisition, analysis, or interpretation of data: Sumaiya Hira, Saba Pirzada

Drafting of the manuscript: Saba Pirzada

Critical review of the manuscript for important intellectual content: All authors

Statistical analysis: Sumaiya Hira

Obtained funding: Not applicable

Administrative, technical, or material support: Not applicable

Supervision: Not applicable

Conflict of Interest Disclosures: None reported.

Funding/Support: None

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