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

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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.

Material and Methods:
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.

Results:
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 the incorrect use of prescribed medicines for over half of all drugs [2]. Incorrect way to instil such as not washing the hand and touching the dropper's tip to the eye or pouring more than prescribed drops reduces the bioavailability of drug thus increasing the systematic absorption raising cost of treatment [3,4]. A study conducted in Canada on a multicenter level shows poor dexterity and advanced age contributes to technique being incorrectly performed in glaucoma patients[5]. Additionally in a study conducted in Hong Kong, older adults constantly demonstrated suboptimal practices, By using the educational interventions improved outcomes[6]. Environmental safety is another additional dimension such as disposing unsused or expired medication in household trash can or sink contributes to pharmaceutical pollution[7]. Limited awareness of disposal safety has been confirmed by multiple surveys in South Asia, including Pakistan as many patients just dump the medications in regular trash can [8]. Further Evidences from Eritrea shows how different determinants like gender, education and ocular comorbidities influence proper administration[9]. Further studies from Ethiopia and Saudi Arabia are also reporting poor administration scores, ranging from 16% to 40% correct technique[10,11]. Despite this, literature from Pakistan remains scarce. As Karachi is one of the largest cities with diverse urban population, evaluation of instillation practices and disposal behaviors here will be providing insights for designing targeted interventions. This paper therefore aims to check both the technique used and practice of disposing ophthalmic medication, and to identify the predictors of correct technique.

Methods

It was an analytical cross-sectional study conducted between January and April 2025 at the Department of Ophthalmology and Visual Sciences, SMBBIT, Karachi, and a private eye clinic. The study included adult patients aging ≥18 years who were prescribed ophthalmic medications (drops or ointments) for at least one week. Exclusion criteria was any one with severe cognitive impairment, acute ocular trauma, or inpatient admission, following approaches adopted in similar international studies. Sampling technique used was the convenience sampling technique due to approach constraints. Data was collected using a structured questionnaire which was pilot tested 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 like means, SDs, and percentages were summarized for demographic and clinical variables. Independent t-tests used to compare 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 version 26.

Results

Table 1 shows the demographical data and clinical profile of the study subjects. The mean age of respondents was 53.8 years. More than half of the participants were female (54.8%). Educational status was evenly distributed. 33.9% got the prior ocular surgery, 34.7% 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)
	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 subjects scored significantly higher than males (p=0.003). Similarly, educated patients, and those who got their surgery done and received professional instructions showed better technique scores.

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*

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Variable	Mean Score ± SD	t-value	p-value
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 a critical gap which needs to be addressed in ophthalmic medication administration and disposal among patients in Karachi. Only about 20% subjects are practicing hand hygiene before instillation of eye medication, and fewer than 20% performing nasolacrimal occlusion (NLO), in line with the findings from both Eritrea and Ethiopia[9,10]. Furthermore, studies in other low- and middle-income settings strech this trend like patients letting the bottle touch to the tip of the eye while instilling the drops, resulting in compromising safety and hygiene increasing infection[11-14]. Worldwide, poor technique is well-documented. In Belgium, incorrect technique like lacking closure of eyelid and NLO was common, particularly among elderly patients with dexterity challenges[13]. Additionally in clinics of glaucoma , video analysis revealed errors conducted in Canada while droping the medicine in eyes[5,15,16]. It has been also seen that educational videos for pharmacist led coaching results in improvement of techniques and scoring [7,17]. In this study, the mean technique score of 4.0/7 matches the results from Eritrea's 4.16 mean score[9], supporting the systemic nature of this problem in the context of demographic [18]. Determinants of accurate technique emerged: female gender and literacy had been linked with better performance, aligning with patterns seen in Eritrea and Ethiopia [9,19]. Counseling before prescribing the medicine and experiences such as any surgery before also showed positive effects. In line with adherence-focused studies in Ghanaian and Indian cataract cohorts[10,20]. Disposing practices are equally concerning as 76% of participants discarded drops in household trash. Broader regional data debates on the similar behavior in Pakistan's Quetta city and South Asia in general [8]. Internationally, improper disposal such as in sink and trash contributes to pharmaceutical pollution, contaminating surface water and aquatic ecosystems [21-24]. EPA also reports show landfill leachate and flushed medications give a persistent environmental contamination[12]. Literature also confirms that even wastewater treatment facilities often fail to remove these micropollutants[15,13,25]. Plastic wastage is another challenge as disposing a single use eye drop vials generates notably more plastic than multi-dose systems. The relying 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 systematic exposure [4,11].

Strength & Limitations

This paper not only relied on self reporting but combined direct observation with self-reporting together to ensure more correct assessment of how drops have been instilled. Furthermore, assessing in a public tertiary center and a private clinic enhances generalizability. Despite of this, being cross-sectional, causality cannot be inferred. Convenience sampling used may have introduced biasness, also 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:

Ms 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

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