Original Article

Enhancing the Technique of Eye Drop Administration through Evaluation and Education: A Quality Improvement Initiative

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ABSTRACT

Purpose: To evaluate the eye-drop administration technique and see the effect of education in improving the eye drop delivery method.

Study Design: Interventional case series.

Place and Duration of Study: Central Park Teaching Hospital Lahore from May-2022 to September-2022

Methods: This study includes 341 patients who had been self-administering eye drops as a treatment for glaucoma or any other disorder. The patients were asked to instill the drop by using a 5ml Systane bottle, as they would do at home. Two observers assessed the technique. Patients were educated about the techniques and they were re-assessed in the form of a post-test. They were evaluated by the same observers again. Data was analyzed using Fisher's Exact test.

Results: A significant improvement was observed in several parameters, including the mean time (in seconds) taken to instill the first drop, the number of drops squeezed, the number of drops reaching the conjunctival sac at the first attempt, hand washing, shaking the bottle before instillation, tilting the head backward during drop instillation, and the occurrence of drops falling on the cheek ($p \leq 0.05$). Conversely, statistically insignificant improvements were noted in parameters such as touching the tip of the dropper and closing the eye for a minute.

Conclusion: The findings underscore the importance of enhancing patient education regarding the correct technique for drop instillation.

Key Words: Compliance, Eye drops, Education, Evaluation, Self-administration.

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INTRODUCTION

The eye is a complicated organ with distinctive anatomy and physiology, hence optical drug delivery is one of the most fascinating and taxing ventures faced by healthcare professionals.[1] Contrary to oral medication, the patients have to use a proper technique for the successful administration of topical medication. It is expected that topical medication is used to affect a certain part of the eye but sometimes it also causes harmful systemic effects.[2]

There are some factors that contribute to the failure of proper eye drop instillation like muscle dystrophies, female sex, arthritis, inadequate posterior bending of the head, severe visual-field defects, lack of positive reinforcement to take eye drops, lower educational level, low self-efficacy, shape and hardness of eye dropper bottles and drug viscosity.[3] Ophthalmologists are advising eye drops without demonstrating the method for correct eye drop

instillation because of shortage of time and this leads to certain factors in which improper technique is used i.e. instilling more drops than the capacity of the conjunctival sac, tapping the eye or tissues around it with the tip of eye drop bottle etc.[4] The patient has to follow the proper technique to administer eye drops in order to get the best result. Studies have shown that 25% to 90% of patients fail to administer eye drops properly.[5] Previous studies have shown that more than 80% of patients instill their own eye drops, out of which 10% of doses were not administered by 62% of the patients.[6] Recently a study was done on patients of an eye disease and more than 50% of them were unable to introduce a single drop properly onto the surface of the eye on their first try.[7]

Compliance is a determinant of treatment success and failure to comply is a major problem that affects the whole health care unit. Non-compliance worsens the disease and adds more cost to treatment.[8] The obstacle to non-compliance can be overcome by interaction with the patients. The effectiveness of topical ocular pharmacotherapy entirely depends on the patient's compliance with the given regimen.[9,10]

The purpose of this study is to evaluate the instillation of eye drop in patients and see the differences after instructing them about proper eye drop instillation techniques and educating them about their importance.

METHODS

This study was conducted at the Central Park Medical College in Lahore, Pakistan. The Ethics Review Committee of Central Park Medical College approved it. All regulations regarding the ethical use of human volunteers were followed during this research. The protocol followed the declaration of Helsinki. In this cross-sectional study, patients who had been self-administering eye drops due to glaucoma, ocular hypertension, or any other disorder were evaluated between 30th April 2022 and 30th September 2022. A sample size of 341 was calculated by the WHO calculator with a confidence level of 95% and a margin of error of 5%.

Adults (ages between 18-60 years), who were self-administering eye drops for more than a week, for one or both eyes were included in the study. Adults greater than 60 years of age, patients suffering from a gross muscular disease such as Parkinson's or muscle dystrophies, patients using eye drops for less than a week, handicapped individuals who were not instilling their drops, patients who used compliance aid and patients with mental illness were excluded from the study.

Informed consent was obtained from each subject. The patients were seated comfortably in a designated area away from the crowd, maintaining patient privacy. The patient was calmed and pacified to minimize the errors in performance due to pressure or nervousness. The patient was given the choice of using whichever hand he wanted to use depending on whether he was right-handed or left-handed. Necessities such as sanitizer, mirror, and tissues were provided beforehand. They were then instructed to instill the drop by using a 5ml Systane bottle, as they would do at home. Two observers stood at a reasonable distance from the patient such that they had direct and lucid sight of the patient performing the technique.

For the patient using drops in one eye, the drop was administered only in that eye. The drop was administered in both eyes for the patient using drops in both eyes. In case the patient panicked, another chance was given but no persuasion or reminding was done. The same observers were available for all patients.

The parameters observed were based on previous studies but slightly modified and compiled as illustrated in Table 1.[5,7] The parameter checklist was crosschecked and verified by expert ophthalmologists at the Eye Department CPTH. Correct instillation of the eye drop (Satisfactory technique) was specified as placing only one drop on the eye in a way that the bottle does not touch any part of the eye. The data was entered and analyzed using SPSS 25.

Table 1: *Observed parameters.*

Parameters
Washes hands prior to instillation
Shakes the ophthalmic suspension bottle before use
Tilts head backward
Directs bottle to eye
Is able to squeeze the bottle to produce a drop
Number of drops squeezed
Number of drops reaching the conjunctival sac at the first attempt
Time taken to instill the first drop
Drop does not miss eye
Does not touch bottle tip to eye
Closes eye for a minute or Blocks tear duct to prevent drainage.

Table2: *Descriptive measures of Demographic and Clinical Appearances.*

Variable	Categories	Number of Subjects	Percentages
Age (years)	< 20	9	2.6
	20 – 29	138	39.8
	30 – 39	110	31.7
	≥ 40	90	25.9
Gender	Male	176	50.7
	Female	171	49.3
Education Level	Basic Schooling	137	39.5
	Intermediate	99	28.5
	University	111	32.0
Previous knowledge of drop instillation (if yes, what is the source)	No	256	73.7
	Yes-Family member	61	17.5
	Yes-Professional	30	8.6
Type of drop instilling instructions	None	256	73.7
	Visual	20	5.76
	Verbal	71	20.4
Posology (frequency of drops)	1 time	115	33.1%
	2 time	118	34.0%
	3 time	101	29.1%
	4 or more	13	3.7%
Duration of using eyes drops (years) n (%)	< 1	272	78.4
	1– 3	62	17.9
	> 3	13	3.7
Total		**347**	**100.0%**

Table3: *Summary of the various parameters observed during eye drops instillation (before and after the instructions).*

Parameters	Results		P-Value
	Before	After	
Mean time (in sec) taken to instill the first drop ± standard deviation	10.05 ± 20.7	8.14 ± 16.15	0.054£
Mean number of drops squeezed ± standard deviation	2.18 ± 1.40	2.03 ± 1.609	0.007£
Mean number of drops reaching the conjunctival sac at the first attempt ± standard deviation	1.73 ± 1.53	1.82 ± 1.662	0.029£
Patients who did not wash hands prior to installation n (%)	202 (58.2)	26 (7.5)	0.021§
Patients who did not shake the ophthalmic suspension bottle before use n (%)	198 (57.1)	24 (6.9)	0.009§
Patients who did not tilt head backward n (%)	41 (11.8)	13 (3.7)	0.000§
Patients who had the eye drop fall on the cheek/lid n (%)	79 (22.8)	20 (5.8)	0.025§
Patients who touched the tip of the dropper n (%)	174 (50.1)	23 (6.6)	0.137§
Patients who do not close eye for a minute or block tear duct after drop instillation to prevent drainage in the sac n (%)	230 (66.3)	12 (3.5)	0.115§

£ = t-test ; § = Fisher's exact test

RESULTS

The data was gathered from 347 patients. The demographic and clinical characteristics of the patients are shown in Table 2. There were 171 female and 176 male patients. The mean age of the patients was 33.76 ± 22.51. Out of the total, 187(53.9%) patients had never used their drops properly. Only 31/347 (8.9%) remembered receiving instructions from an ophthalmologist on how to use their drops. From the total only 129 (37.2%) have recalled receiving instructions on how to use their drops from family members (Table 2).

Table 3 summarizes the results of the major parameters investigated. Only 310 (89.3%) patients were able to successfully apply eye drops without the bottle tip touching their eye or eyelid before the eye drop installation instructions, while 331 (95.4%) patients correctly applied the drops after receiving the information. The majority of patients did not wash their hands but results improved after guidance (p-value=0.021).

The findings of the present study suggest that after learning the drop installation technique, there was improved performance. Because of poor instillation technique, a significant volume of eye drops was wasted, but after learning the proper placement method, outcomes significantly improved (p-value <0.05).

DISCUSSION

The primary objective of the study was to assess the proficiency of patients in administering eye drops. The study outcomes revealed a notable issue with eye drop instillation technique that patients encounter.[11] Consistent with prior research, the current study results suggest that individuals who are experienced in using eye drops face difficulties when trying to correctly apply them.[12]

The study found that poor eye drop instillation technique was primarily due to contact between the bottle tip and the eye or eyelid, which could result in contamination.[13,14] This finding aligns with the results of other studies that suggest that contamination of eye drops occurs due to incorrect instillation technique.[15] A significant amount of eye drops were wasted due to faulty instillation techniques. It has been reported that 79 (79.9%) out of 99 patients missed their eye while instilling drops.[16]Improper administration of eye drops can result in the advancement of diseases due to missed medication doses as well as ocular trauma if the tip touches the cornea.[17] Moreover, incorrect administration techniques may lead to the wastage of eye drops, causing economic concerns for patients.[18] This issue is particularly significant for patients from low socioeconomic backgrounds in developing countries, such as those in the setting of the current study.

The study suggests that educating patients on proper drop instillation technique is crucial, especially since many patients have not received instructions. It is of extreme significance that, the number of people who had the knowledge (26.2%) was fairly low compared to those who did not receive any instructions (73.7%) on how to correctly administer eye drops. This is quite an alarming number as 34% of the patients instill 2 drops daily while 33.1% instill a drop a day. In addition, it was observed that only 11% of the patients complied with hand washing. The study recommends the necessity for improved instructional methods and devices, as well as educating patients with easily understandable information tailored to their educational level.[19]

The study concluded that there was a significant improvement in the performance of patients after receiving education on eye drop installation. It has been noted that the patients who had previous education on drop instillation technique did better than those who did not receive any instructions.[20]

After receiving education on eye drop installation, patients demonstrated an improvement in the technique used as existing studies and research have demonstrated.[21] It is important to provide comprehensive education and awareness to all eye care practitioners regarding the proper technique for instilling eye drops.[22] This can effectively minimize or eliminate non-compliance and incorrect methods of drop instillation among patients.

The limitations of this study include variability in bottle design and surroundings, and the impact of clinic-induced stress on patient behavior. Additionally, the study may be influenced by bias due to its clinical setting, which may have prompted participants to modify their behavior. Improving drop instillation technique is important for patients, especially those with financial difficulties in buying medication.

CONCLUSION

The research underscores the importance of enhancing patient education regarding accurate techniques for applying eye drops. The results indicate that educating patients about the correct method of instilling eye drops is crucial for enhancing treatment effectiveness and minimizing medication wastage. There is a need for advancements in instructional methods and devices to assist patients in administering their eye drops more effectively. Improving patients' proficiency in self-administering eye drops necessitates providing comprehensive education, including instructional videos demonstrating the proper technique for instilling eye drops.

Conflict of Interest: Authors declared no conflict of interest.

Ethical Approval: The study was approved by the Institutional review board/Ethical review board **(CPMC/IRB-No/1329).**

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