

RESEARCH ARTICLE

Evaluation of eye drop self-administration technique in a sample of casual eye drop users

Nurazreen Farahin Alhamzah¹, Shaz' Ain Razak^{2*}, Nor Azeera binti Mohd Ali¹

¹Department of Optometry and Vision Science, Faculty of Health and Life Sciences, Management and Science University, 40100 Shah Alam, Selangor, Malaysia. ²Centre of Optometry, Faculty of Health Sciences, Universiti Teknologi MARA, Selangor Branch, 42300 Bandar Puncak Alam, Selangor, Malaysia;

Abstract:

The correct eye drop instillation technique plays a major role to ensure the success of the treatment. This study aims to evaluate the eye drop instillation technique in a sample of casual eye drop users and its associated factors. A cross-sectional study was done among self-administered casual eye drop users and their details had been profiled. All subjects were asked to demonstrate their instillation technique while a video recorder was used for recording and a grading chart was referred to score the technique from -1 to +4. A total of 50 subjects with 11 (22.0%) male and 39 (78.0%) female with a mean age of 22.14 (± 2.70) years were involved. The major reason for eye drop usage is dryness (58.0%) followed by itchiness (14.0%), redness (12.0%), combination (12.0%), and others (4.0%). 28 (56.0%) of subjects had non-prescribed eye drop while 30 (60.0%) had no previous education regarding proper instillation techniques. Mean instillation technique score is 2.26 (± 1.43) with 26 (52.0%) subjects having poor instillation techniques. In conclusion, majority of subjects had a poor technique in instilling eye drops. Thus, future research should emphasize on best methods of eye drops prescription to ensure the effectiveness of medication through self-instillation eye drops.

*Corresponding Author

Shaz' Ain Razak
Email:
shazain@uitm.edu.my

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1. INTRODUCTION

The practice of self-medication is opted to treat self-recognized illnesses or symptoms, and self-limiting conditions without referring medical advice; showed high prevalence worldwide (Ali et al., 2012; Elkalmi et al., 2018). Ophthalmic self-medication in the form of ocular suspension has been used to manage various ocular symptoms such as redness, itchiness, foreign body sensation, dry eye, and sore eye (Adimassu et al., 2020; Mehuys et al., 2020) which some of the suspension can be purchased over the counter. In contrast, there are ocular suspensions that require a physician's prescription such as antiglaucoma preparation and corticosteroid anti-inflammatory agents. Nevertheless, both demands appropriate eye drop self-administration skill and technique for the solution to act effectively on the site of action.

An improper eye drop instillation technique leads to treatment non-compliance (Gupta et al., 2012). In certain conditions, the prescribed medical treatment would be wasted, unsuccessful, and might contribute to the disease progression, or in the opposite, they might be introduced with additional drops which could risk local or systemic side effects (Tatham et al., 2013). Tips of the bottles were more often contaminated than the content of the eye drop (Usgaonkar et al., 2021). A

sample of ophthalmic solution in the ophthalmology department found that 72.8% were contaminated; whereby the contamination was high among self-administered and those who administered less frequently (Tamrat et al., 2019).

The use of self-medicate eye drops could be high due to easy access to self-medicate (Kadri et al., 2011), and high numbers of dry eye incidence among contact lens wearers or prolonged visual display unit users (Reddy, 2016). The correct instillation technique plays a major role to ensure the success of the treatment. However, little is known about the efficacy of the eye drop instillation technique among over-the-counter eye drop users or in the non-hospital samples. Hence, this study aimed to evaluate the efficacy of the eye drop instillation technique in a sample of casual eye drop users and its associated factors.

2. MATERIALS AND METHODS

This cross-sectional study uses convenient sampling on a sample of eye drop user that visits an optometry private practice in Shah Alam, Selangor. The appropriate sample size needed was calculated using the Raosoft online sample size calculator. Based on 70 estimated population size, 50% response distribution, 5% margin of error and 95% confidence interval there were 60 recommended sample size.

The study population consisted of participants who are above 18 years old, self-administered eye drop users, and able to understand in Malay or English language. The subjects with poor near vision (worse than N8@20cm), had motor difficulties such as arthritis, tremors, motor paralysis or Parkinson, and did not instill eye drops by themselves or use any compliance aid to instill eye drops were excluded from this study. All subjects were required to sign a consent form prior to data collection indicating their agreement to participate in this study.

The demographic data such as gender, and age were recorded. The participants were also asked about their purpose of using eye drop, frequency of eye drop used, duration of eye drop used, the status of eye drop prescriber, sources of eye drop used, previous education on eye drop instillation technique, and level of difficulty in instilling eye drop. The clinical data such as unaided near visual acuity and grading score of eye drop instillation technique also were collected and recorded.

Subsequently, the subjects were asked to instill the eye drop by using their own eye drops, specifically in bottle form on one of their preferred eyes and condition, as they would normally do at home. However, those who forgot to bring their eye drops were supplied with another eye drop (5 ml Systane® lubricant eye drops, Alcon Laboratories, Inc., Ft. Worth, Texas, USA). The certified optometrist and video recorder were stationed at a comfortable viewing distance to the subjects and viewing angle so that the technique of eye drop instillation can be carefully and clearly observed and recorded. The score was given based on their technique in instilling the eye drop by referring to a grading chart (Tatham et al., 2013). The scores are ranging from -1 to 4 in which Grade 4 and 3 are indicated as good technique while Grade 2 to -1 are indicated as poor technique. The detail of grading was shown in Table 1.

Table 1. Grading of eye drop instillation technique (by Tatham et al., 2013)

Description of technique	Score
1) Good technique, is on target, delivers a drop to the eye, and does not contaminate the bottle	4
2) Awkward technique, but is on target, delivers a drop to the eye, and does not contaminate the bottle	3
3) On target and delivers a drop to the eye but contaminates the bottle by touching the bottle tip to the lashes or lid	2
4) Target and delivers a drop to the eye but contaminates the bottle by touching the bottle tip to bulbar conjunctiva or cornea (lower score due to added risk of trauma to ocular surface)	1
5) Not on target and misses the eye with the eye drop	0
6) Patient misses the eye with the eye drop and contaminates the bottle tip by touching the eye, eyelid or lashes	-1

Data entry and statistical analysis were carried out using Statistical Package for Social Science (SPSS) software Version 26.0 (SPSS Inc. Chicago, IL, USA). Descriptive analyses were used to describe the demographics and characteristics of eye drop users; the quantitative data were expressed as mean and standard deviation and qualitative data were expressed as frequency and percentage of each category. The Pearson Chi-Square Correlation was then used to determine the association between the demographic factors and eye drop user characteristic towards the grade of eye drop instillation technique.

3. RESULTS AND DISCUSSION

3.1. Demographic distribution, eye drop user characteristics and eye drop instillation technique

The study was conducted among 50 subjects consisting of 11 (22.0%) male and 39 (78.0%) female with mean age of 22.14 (±2.70) years. The main reason of eye drop usage is due to dryness (58.0%) followed by itchiness (14.0%), red eye (12.0%), combination of dryness, itchiness and red eye (12.0%), and others (4.0%) such as to rewetting eye during contact lens wear and tired eye. However, most of them would use their eye drop only when necessary (70.0%) while only 18.0% of them used the eye drop almost every day and 12% a few times weekly. Majority (40.0%) of subjects had used the eye drop less than six months, followed by less than a month (32.0%), more than six months but less than a year (18.0%) and more than a year (10.0%).

Regarding the difficulty in instilling eye drop, most of them (58.0%) were reported of having no problem in instilling the eye drop and only 42.0% had reported of touching the tip of eye drop bottle with their eye occasionally. Besides that, the usually position of instilling eye drop that reported by subjects were mostly in sitting position (48.0%) followed by standing (16.0%), lying down (8.0%), and varies position (28.0%). 56.0% agreed they had only sometimes washed their hand before instil the eye drop. The source of eye drops purchased was majority (76.0%) from community pharmacies followed by others (10.0%) such as relatives or chain store, clinic (8.0%), and optical shop (6.0%). However, most of the subjects were non-prescribed eye drop users (56%) and majority (60.0%) of subjects did not receive any previous education about proper technique to instil the eye drop. The detail about eye drop characteristics was shown in Table 2.

Overall scoring of self-administration eyedrop in this study showed a mean of 2.26 (1.43). Half of (52.0%) of them had poor technique in instilling eye drops. The highest score was grade 2 (30.0%), which contaminated the bottle tip to their eyelashes or eyelid. The detail of the score of instillation technique were shown as below in Figure 1.

Table 2. Demographic distribution and characteristics of eye drop users in this study

Variables	Frequency (%)
Age (Years)	
18 to 23	38 (70)
24 to 30	12 (24)
Gender	
Male	11 (22)
Female	39 (78.0)
Near VA	
N5 to N6 at 40cm	46 (92)
N8 and poorer at 40cm	4 (8)
Characteristic of eye drop users	
Purpose of Using Eye Drop	
Dryness	29 (58)
Itchiness	7 (14)
Red eye	6 (12)
Combination	6 (12)
Other	2 (4)
Frequency of Using Eye Drop	
Almost Everyday	9 (18)
A Few Time Weekly	6 (12)
When Necessary	35 (70)
Duration of Using Eye Drop	
≤ A Month	16 (32)
≥ A Month ≤ Six Months	20 (40)
≥ Six Months	14 (28)
Prescribe by health practitioners	
Yes	22 (44)
No	28 (56)
Receive Previous Education regarding Instillation Technique	
Yes	30 (60)
No	20 (40)
Source of Purchase Eye Drop	
Clinic	4 (8)
Pharmacy	38 (76)
Optical Shop	3(6)
Other	5 (10)
Type of eye drop bottle	
Bottle	46 (92)
Pipette	4 (8)
Self-perceived technique	
Difficulty in Installing Eye Drop	
None	29 (58)
Little	21 (42)
Hand Wash Before Instill Eye Drop	
Always or Usually	22 (44)
Sometimes or Rare	28 (56)
Bottle Tip Contaminated with Eye	
None	29 (58)
Little	21 (42)
Missing eye drop	
Always/usually/sometime	10 (20)
Rarely/ never	40 (80)
Hold lids	
Both upper / lower	23 (46)
Upper	8 (16)

Lower	17 (34)
No lids is shield	2 (4)
Self-preferred condition	
Mirror	
Yes	9 (18)
No	41 (82)
Position of Instilling Eye Drop	
Standing	8 (16)
Sitting	24 (48)
Lying Down	4 (8)
Varies	14 (28)

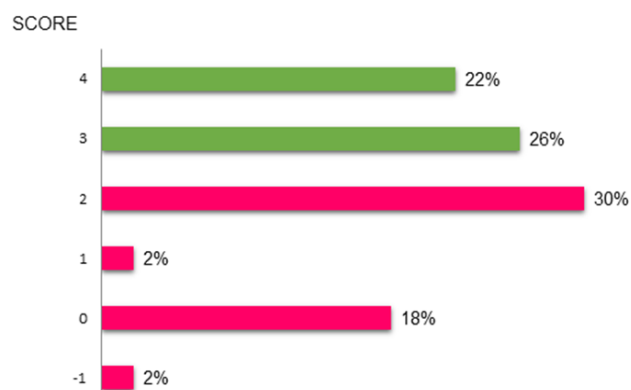


Figure 1. Frequency of total score of eye drop instillation technique. Grade 4 and 3 are indicated as good technique while Grade 2 to -1 are indicated as poor technique.

3.2. Association of eye drop instillation technique and eye drop user profile

The Chi Square analysis between demographic factors (gender, age group, and near VA) showed no significant association with eye drop instillation technique ($p > 0.05$). The frequency of eye drops usage is significantly associated with the eye drops instillation technique ($p = 0.043$). The other characteristic of eye drops users showed no significant association with the instillation techniques (purpose of eye drops usage ($p = 0.205$), duration of eye drop usage ($p = 0.190$), status of prescribed eye drop user ($p = 0.802$), and difficulty in instilling eye drop (0.077), level of difficulty in instilling eye ($p = 0.642$). Further details were tabulated as shown in Table 3.

Table 3. Analysis of Chi Square Test for (a) Demographic factors, (b) Characteristic of eye drop users (c), Self-perceived technique (d) Preference in eye drops instillation

Factor	X ²	Df	p value
a) Demographic			
Age group	0.025	1	0.874
Gender	0.037	1	0.848
Near VA	0.921	1	0.337
b) Characteristic of eye drop users			
Purpose of using eye drop	5.916	4	0.205
Frequency of using eye drops	6.298	2	0.043
Duration of Eye Drop Usage	3.318	2	0.190
Status of Prescribed	0.063	1	0.802
Previous Education	0.120	1	0.729
Type of eye drops used	0.007	1	0.933
c) Self-perceived technique			
Level of difficulty	3.120	1	0.077
Hand wash	0.102	1	0.749
Touch bottle tip	1.623	1	0.203
Missing eye drops	4.189	2	0.123
d) Preference in eye drops instillation			
Hand used	0.086	1	0.769
Finger used	2.946	1	0.086
Finger used	4.043	3	0.257
Hold lids	0.874	3	0.832
Position	0.946	1	0.331
Use of mirror			

3.3. Instillation technique among casual eye drop user

Many previous studies had found a significant poor eye drop instillation technique among eye drop user (An et al., 2014; Gupta et al., 2012; Schwartz et al., 2013; Tatham et al., 2013) yet majority of the studies were done in glaucoma patient from hospital setting. This preliminary study provides an overview of the eye drop instillation technique among the casual eye drop user which has been long neglected. However, similar with hospital-prescribed-eye drop user, majority of the subjects in this study showed poor eye drop instillation technique with many contaminates the bottle by touching the bottle tip to the lashes or lid.

Previous studies agreed that majority of the eye drop user had poor instillation technique due to contamination of the tip of the bottle with the eyelashes, eyelid, conjunctiva or cornea, missing the eye droplet, failing to close the eye, not performing nasolacrimal occlusion, or not washing their hand before instillation (Davis et al., 2018; Eaton et al., 2015; Gao et al., 2018; Gupta et al., 2012; Mehuys et al., 2020; Tatham et al., 2013). This study would like to see factors that can associates to the poor instillation technique yet only frequency of using eye drop shows significance association (p<0.05). Few studies had suggested that the longer the duration or the higher the frequency of administration, the higher association with the poor compliance (McVeigh & Vakros, 2015),

however many are inconclusive. As for frequency of administration, a study had suggested that less frequent and keeping the prescribed medication as simple as possible may diminished the rate of poor compliance (Konstas et al., 2000).

Other external factors such as older age, poor vision, low educational level and lack of education on correct instillation technique are related to poor eye drop application (Davis et al., 2018; Gao et al., 2018; Tatham et al., 2013). In this study, almost half of the subjects claimed received previous education regarding instillation technique (40%) though not reflect on the good score. Most of the previous studies stated that received previous instruction about proper instillation technique are just based on patient’s self-reported and recalled (Gomes et al., 2016; Schwartz et al., 2013) which did not explain how the previous instruction was given to the patient either in structurally manner or not.

Even though instilling an eye drop seems to be a simple procedure, consistent findings throughout previous studies suggest appropriate education regarding eye drop instillation technique should be conducted whether in hospital and non-hospital setting. Currently, clinicians might prescribe without properly demonstrating the correct technique due to busy clinic or failure to recognize that the patient may not be able to use the eye drops appropriately (Gupta et al., 2012; Usgaonkar et al., 2021).

There are some limitations of this study. Sampling was done on one optometry private practice base on walk in basis, hence limited variation of casual eye drop user and small sample size was obtained. Second, the evaluation was video recorded which may cause unnatural behavior of eye drop application. Also, the self-reported eye drop user profile may also create a bias, thus requires a pre and post study prior receiving eye drop instruction technique in variety clinical setting and user profile to obtain a significance finding. A comparison between demographic factors may increase the strength of study for the evidence of training is or not needed for the instillation of eye drops.

4. CONCLUSION

This study demonstrates a poor eye drop instillation technique in a sample of casual eye drop user. Even most of the eye drop user self-reported that they had no trouble to instil their eye drops and never contaminate the bottle tip of eye drop with their eye, the evaluation shows the opposite findings. Education on appropriate eye drop instillation technique is warranted prior to eye drop prescription to avoid negative clinical outcomes. Future research should emphasize on best methods of eye drops prescription to ensure the effectiveness of medication through self-instillation eye drops.

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REFERENCES

- Adimassu, N. F., Woldetsadik, Z. G., & Alemu, H. W. (2020). Proportion of Ophthalmic Self-Medication and Associated Factors among Adult Ophthalmic Patients Attending Borumeda Hospital, Dessie, Northeast Ethiopia. *Journal of Ophthalmology*, 2020, 1-7. <https://doi.org/10.1155/2020/6932686>
- Ali, A. N., Kai, J. T. T. K., Keat, C. C., & Dhanaraj, S. (2012). Self-medication practices among health care professionals in a Private University, Malaysia. *International Current Pharmaceutical Journal*, 1(10), 302-310. <https://doi.org/10.3329/icpj.v1i10.11846>
- An, J. A., Kasner, O., Samek, D. A., & Lévesque, V. (2014). Evaluation of eyedrop administration by inexperienced patients after cataract surgery. *Journal of Cataract and Refractive Surgery*, 40(11), 1857-1861. <https://doi.org/10.1016/j.jcrs.2014.02.037>
- Davis, S. A., Sleath, B., Carpenter, D. M., Blalock, S. J., Muir, K. W., & Budenz, D. L. (2018). Drop instillation and glaucoma. *Current Opinion in Ophthalmology*, 29(2), 171-177. <https://doi.org/10.1097/ICU.0000000000000451>
- Eaton, A. M., Gordon, G. M., Konowal, A., Allen, A., Allen, M., Sgarlata, A., Gao, G., Wafapoor, H., & Avery, R. L. (2015). A novel eye drop application monitor to assess patient compliance with a prescribed regimen: A pilot study. *Eye (Basingstoke)*, 29(10), 1383-1391. <https://doi.org/10.1038/eye.2015.155>
- Elkalmi, R. M., Elnaem, M. H., Rayes, I. K., & Mohamed, R. (2018). *Perceptions, Knowledge and Practice of Self-Medication among Undergraduate Pharmacy Students in Malaysia: A Cross Sectional Study*. 4(3), 132-136.
- Gao, X., Yang, Q., Huang, W., Chen, T., Zuo, C., Li, X., Gao, W., & Xiao, H. (2018). Evaluating eye drop instillation technique and its determinants in glaucoma patients. *Journal of Ophthalmology*, Apr 8, 1-7. <https://doi.org/10.1155/2018/1376020>
- Gomes, B. F., Lordello, M., Celli, L. F., Santhiago, M. R., & Moraes, H. V. (2016). Comparison of eyedrop instillation technique with and without a delivery device in inexperienced patients. *European Journal of Ophthalmology*, 26(6), 594-597. <https://doi.org/10.5301/ejo.5000797>
- Gupta, R., Patil, B., Shah, B. M., Bali, S. J., Mishra, S. K., & Dada, T. (2012). Evaluating eye drop instillation technique in glaucoma patients. *Journal of Glaucoma*, 21(3), 189-192. <https://doi.org/10.1097/IJG.0b013e31820bd2e1>
- Kadri, R., Hegde, S., Kudva, A. a, Achar, A., Shenoy, S. P., & Res., I. J. B. M. (2011). Self-medication with over the counter ophthalmic preparations: is it safe? *International Journal of Biological & Medical Research*, 2(2), 528-530.
- Konstas, A. G. P., Maskaleris, G., Gratsonidis, S., & Sardelli, C. (2000). Compliance and viewpoint of glaucoma patients in Greece. *Eye*, 14(5), 752-756. <https://doi.org/10.1038/eye.2000.197>
- McVeigh, K. A., & Vakros, G. (2015). The eye drop chart: A pilot study for improving administration of and compliance with topical treatments in glaucoma patients. *Clinical Ophthalmology*, 9, 813-819. <https://doi.org/10.2147/OPHTH.S82909>
- Mehuys, E., Delaey, C., Christiaens, T., Van Bortel, L., Van Tongelen, I., Remon, J. P., & Boussery, K. (2020). Eye drop technique and patient-reported problems in a real-world population of eye drop users. *Eye (Basingstoke)*, 34(8), 1392-1398. <https://doi.org/10.1038/s41433-019-0665-y>
- Reddy, S. C. (2016). *A Survey of Dry Eye Symptoms in Contact Lens Wearers and Non-Contact Journal of Clinical & Experimental A Survey of Dry Eye Symptoms in Contact Lens Wearers and Non-Contact Lens Wearers among University Students in Malaysia*. November, 8-13. <https://doi.org/10.4172/2155-9570.1000522>
- Schwartz, G. F., Hollander, D. A., & Williams, J. M. (2013). Evaluation of eye drop administration technique in patients with glaucoma or ocular hypertension. *Current Medical Research and Opinion*, 29(11), 1515-1522. <https://doi.org/10.1185/03007995.2013.833898>
- Tamrat, L., Gelaw, Y., Beyene, G., & Gize, A. (2019). Microbial Contamination and Antimicrobial Resistance in Use of Ophthalmic Solutions at the Department of Ophthalmology, Jimma University Specialized Hospital, Southwest Ethiopia. *Canadian Journal of Infectious Diseases and Medical Microbiology*, 2019, 6-8. <https://doi.org/10.1155/2019/5372530>
- Tatham, A. J., Sarodia, U., Gatrad, F., & Awan, A. (2013). Eye drop instillation technique in patients with glaucoma. *Eye (Basingstoke)*, 27(11), 1293-1298. <https://doi.org/10.1038/eye.2013.187>
- Usgaonkar, U., Zambaulicar, V., & Shetty, A. (2021). *Subjective and objective assessment of the eye drop instillation technique: A hospital-based cross-sectional study Indian J Ophthalmol*, 69(10):2638-2642. https://doi.org/10.4103/ijo.IJO_3333_20