HHS Public Access

Author manuscript

Health Commun. Author manuscript; available in PMC 2022 March 24.

Published in final edited form as:

Health Commun. 2016 August ; 31(8): 1036–1042. doi:10.1080/10410236.2015.1020263.

The Effect of Eye Drop Technique Education in Patients With Glaucoma

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Abstract

Education about how to administer eye drops may improve a patient's ability to instill his or her eye drops correctly. Our objectives were to (a) document the methods providers use to educate glaucoma patients about eye drop technique; (b) determine whether eye drop technique education varies by provider and patient characteristics; and (c) evaluate whether education predicts improved patient technique. We conducted an 8-month longitudinal study of 279 glaucoma patients and 15 providers in which we recorded on videotape the content of glaucoma office visits at two time points (baseline and 4- to 6-week follow-up) and videotaped patient eye drop technique at three time points (baseline, 4- to 6-week follow-up, and 8-month follow-up). Mann–Whitney rank sum tests were used to determine whether education was associated with improved patient eye drop technique over time. Ninety-four patients (34%) received technique education at either visit; 31% received verbal education and 10% received a technique demonstration. Only 24 patients (47%) who were new to eye drops received technique education at the baseline visit. Patients who were new to drops at baseline ($p = .008$) and patients who asked a question about drops ($p < .001$) were more likely to receive technique education. Education was not associated with improved technique. Eye drop technique education occurs infrequently during glaucoma office visits. Future studies should compare the effectiveness of different educational methods, such as patient demonstration versus provider verbal instruction, to determine which method is best at improving patient eye drop technique.

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Glaucoma is the leading cause of irreversible blindness, affecting more than 60 million people worldwide (Tham et al., 2014). Although topical glaucoma medications (i.e., eye drops) can delay progression of the disease and improve clinical outcomes (Heijl et al., 2002; Kass et al., 2002; Lichter et al., 2001; Marquis & Whitson, 2005), patient adherence to glaucoma medications is commonly less than 80% (Boland, Chang, Frazier, Plyler, & Friedman, 2014; Olthoff, Schouten, Van De Borne, & Webers, 2005; Quigley, Friedman, & Hahn, 2007). Many factors affect medication adherence, but the skill required to instill a single drop onto the eye without touching the bottle to the eye or face is a significant patient-level barrier that contributes to low adherence rates (Muir & Lee, 2011; Tsai, 2006). Indeed, research has consistently shown that approximately half of glaucoma patients do not instill their eye drops correctly (Hennessy, Katz, Covert, Protzko, & Robin, 2010; Schwartz, Hollander, & Williams, 2013; Sleath et al., 2011; Stone, Robin, Novack, Covert, & Cagle, 2009; Tatham, Sarodia, Gatrad, & Awan, 2013).

Poor eye drop technique can cause overdosing or underdosing of medication and can be considered a form of unintentional nonadherence, which occurs when patients accidentally or unknowingly do not take their medications as prescribed (Rees, Leong, Crowston, & Lamoureux, 2010). Glaucoma patients are often unaware that they have poor eye drop technique (Hennessy et al., 2010; Schwartz et al., 2013; Stone et al., 2009). One study reported that 25% of patients were unaware of when they had touched their eye with the medication bottle (Hennessy et al., 2010).

According to Self-Regulation Theory (Clark, Gong, & Kaciroti, 2001), technical support from a health care provider can increase patients' knowledge and self-efficacy, which may ultimately increase their engagement in a daily disease management behavior like taking eye drops. Furthermore, the specific manner in which providers provide education and technical support may differentially influence patient knowledge, self-efficacy, and self-management. Certain methods of education have proven more effective at increasing the knowledge and medication skills of patients with other chronic conditions (Bosnic-Anticevich, Sinha, So, & Reddel, 2010; Van Der Palen, Klein, Kerkhoff, Van Herwaarden, & Seydel, 1997). Specifically, inhaler education for chronic obstructive pulmonary disease (COPD) patients that included a technique demonstration was shown to outperform written and verbal education (Bosnic-Anticevich et al., 2010). Additionally, a review of the teach-back technique, in which patients are asked to explain or demonstrate a skill back to their provider after instruction (Doak, Doak, & Root, 1996), found that COPD patients who received the teach-back technique demonstrated better inhaler technique (Dantic, 2014). Although glaucoma researchers have suggested that the teach-back technique may improve patient eye drop technique (Muir & Lee, 2010; Robin, Sleath, & Covert, 2010), previous research has not evaluated the effectiveness of various eye drop technique instruction methods.

Few studies have examined whether eye drop technique education leads to better patient eye drop technique. One study of 164 glaucoma and ocular hypertension patients found that patients who had poor eye drop technique at an initial visit were also likely to have poor technique 12 weeks later (Schwartz et al., 2013). Within that same sample, 42% of patients

reported that they had never received technique instruction. A separate cross-sectional study found that patients who reported receiving technique instruction had 6.7 times higher odds of good technique when compared with patients who did not receive instruction (Tatham et al., 2013). These previous studies used patient reports, rather than objective measures, to document technique education and have not described which educational methods providers use to teach technique.

In order to address these research gaps, we sought to (a) document the methods that providers used to educate glaucoma patients about eye drop technique; (b) determine whether eye drop technique education varied by provider and patient characteristics; and (c) evaluate whether patients who received eye drop technique education demonstrated subsequent technique improvements. We hypothesized that:

H1: Patients who received eye drop technique education at baseline and 4–6-week follow-up would demonstrate better technique at the subsequent office visit.

Method

Patients and procedures

We collected data for this multisite cohort study between 2009 and 2012. Six ophthalmology practices (two private offices and four academic ophthalmology departments) from five distinct geographical regions served as recruitment sites. Providers were recruited in person by either the principal investigator or co-investigators and were told that the goal of the study was to learn about communication during glaucoma visits. Fifteen providers participated and one refused, for a participation rate of 94%. After providing written informed consent, providers completed a demographic questionnaire. This study was approved by the institutional review boards at the University of North Carolina, Duke University, Emory University, and the University of Utah, was HIPAA (Health Insurance Portability and Accountability Act) compliant, and was performed in accordance with the tenets of the Declaration of Helsinki.

When patients arrived for their appointments, clinic staff members referred potentially eligible patients to a research assistant who was located at the clinic. The research assistant explained to patients that the purpose of the study was to improve health services provided in clinics. Eligible patients (a) were ≥ 18 years of age; (b) spoke English; (c) were glaucoma or glaucoma suspect patients; and (d) were mentally competent as determined by the Mental Status Questionnaire (Fillenbaum, Heyman, Williams, Prosnitz, & Burchett, 1990). Ineligible patients were thanked and given $5. Eligible patients were enrolled and had their office visit recorded on videotape. Previous studies have shown that videotaping interactions causes minimal reactance on the part of patients and providers (Penner et al., 2007) and results in coder ratings of medical interactions that are more strongly correlated with theoretical expectations of patient–provider communication (Riddle et al., 2002). Videotapes were kept if they fit one of two criteria: (a) The patient was diagnosed with glaucoma and glaucoma medications were prescribed for the first time, or (b) patients were already taking glaucoma medications. Patients who met either of these criteria were followed for the 8-month study period.

Participants had their medical visits recorded on videotape at two visits (baseline and a 4- to 6-week follow-up) and had their eye drop technique recorded on videotape at three visits (baseline, 4- to 6-week follow-up, and 8-month follow-up). Patients received $20 at the conclusion of each visit. Immediately after their medical visits, a research assistant interviewed patients in a private examination room and videotaped their eye drop administration. Patients demonstrated their technique using a bottle of commercially purchased artificial tears. Patients were asked to instill a single drop onto their eye as they normally would at home. If the patient normally instilled drops into both eyes, the patient was asked to administer a drop onto the right eye. Otherwise, the patient was asked to instill the eye drop into the eye that he or she normally uses for glaucoma medications.

Measures

Eye drop technique—A trained coder used a seven-step checklist to evaluate patient eye drop technique at each time point. The checklist was developed with input from the ophthalmologists on the study team and was informed by the literature on improving the effectiveness of topically applied drops (Glaucoma Research Foundation, 2013; Zimmerman, Kooner, Kandarakis, & Ziegler, 1984). Each of the seven items was scored *yes, no*, or *unclear* for the following steps: (a) tilts head backward while sitting, standing, or lying down, (b) directs bottle to eye, (c) able to squeeze the bottle to produce a drop, (d) drop does not miss eye, (e) instills a single drop, (f) does not touch bottle tip to eye, and (g) blocks tear duct to prevent drainage.

Change in eye drop technique for each of the seven steps was calculated for (a) the baseline visit to the 4- to 6-week follow-up visit and (b) the 4- to 6-week follow-up visit to the 8-month follow-up visit. Change for each step was scored as 1 = improved over time (i.e., the patient performed the step incorrectly at the first visit and performed it correctly at the subsequent visit), 0 = no change over time (i.e., the patient either performed the step incorrectly at both visits or performed it correctly at both visits), or −1 = worse over time (i.e., the patient performed the step correctly at the first visit and then performed it incorrectly at the subsequent visit). We used listwise deletion when calculating change scores due to the number of unclear videotapes. Thus, patients only had change scores calculated for those steps that could be clearly evaluated at both time points.

Education on how to administer eye drops—Each baseline and 4- to 6-week medical visit was transcribed verbatim and identifying information was removed. Over a 1-year period, a detailed transcript coding tool and coding rules were developed to increase intercoder reliability. During the process of coding tool development, the transcripts were reviewed by a research assistant, who met twice a month with the investigators to develop and refine the coding rules. The coding rules contained definitions and example text from the transcripts for the different methods of provider eye drop technique education. Table 1 defines and provides examples of the six methods of education. Each method was scored as *yes* on the paper coding tool if the provider used that method or *no* if he or she did not use that method.

Three coders were trained on how to use the coding rules and coding tool. After training, the coders then practiced coding two transcripts and met with the study team to discuss areas of discrepancy. If intercoder reliability was less than 80% on these initial transcripts, the coders then coded additional transcripts and met with the study team until intercoder reliability exceeded 80%. Throughout the study period, the coders coded 25 of the same transcripts in order to assess interrater reliability. Interrater correlations for the methods of eye drop technique education ranged from 0.84 to 1.00.

For each patient at each office visit (baseline and 4- to 6-week follow-up), we calculated a summary education score by adding together the various types of education that the patient received. We then dichotomized the result, such that 0 = received no eye drop technique education at either visit and 1 = received at least one method of eye drop technique education at either visit.

Patient question-asking about eye drop technique—For each visit, a single coder documented whether the patient asked their provider any questions about how to instill eye drops.

Eye drop technique self-efficacy—During the baseline interview, patients completed a six-item, validated, eye drop technique self-efficacy scale (Sleath et al., 2012). The scale assessed patients' confidence in using their eye drops correctly, including squeezing the bottle, getting the right number of drops into the eye, and not touching the eye with the bottle. Response options ranged from 1 = *not at all confident* to 3 = *very confident*. Items were summed (range: 6 to 18); higher scores indicated greater technique self-efficacy (α = .84).

Health literacy—The Rapid Estimate of Adult Literacy in Medicine (REALM) was administered to assess health literacy (Davis et al., 1993). The REALM is a validated, rapid screening instrument that identifies patients who have difficulty reading common medical terms (Davis et al., 1993; Freedman, Jones, Lin, Robin, & Muir, 2012). REALM scores correspond to reading levels (0–60 = eighth grade and below, 61–66 = ninth grade and above).

Sociodemographic and clinical characteristics—During the baseline interview, patients reported their age, race, gender, years of education, years using glaucoma medications, and whether they were newly prescribed a glaucoma medication. Patient race was measured as a categorical variable (White, African American, Asian, Native American, and Hispanic), and then dichotomized into African American and non-African American. Years using glaucoma medications was measured as a categorical variable (<6 months, 6 months–1 year, and ≥1 year), and then recoded into a dichotomous variable: <1 year versus ≥1 year. Whether the patient was newly prescribed glaucoma medications at the baseline visit was measured as a dichotomous variable (yes/no).

At baseline, information about a patient's arthritis diagnosis (yes/no) and glaucoma severity were extracted from the medical chart. Arthritis diagnosis information was collected because arthritis can physically impair patients' ability to instill drops correctly (Winfield, Jessiman,

Williams, & Esakowitz, 1990). The severity of glaucoma for each eye was classified using the mean deviation of the eye from the last reliable visual field and recoded as mild, moderate, and severe (Hodapp, Parrish, & Anderson, 1993).

Data analysis

We used IBM SPSS Statistics version 19 (Armonk, NY) to perform all analyses. We used descriptive statistics to characterize the sample and document the methods of technique education providers used. Independent-sample *t*-tests and chi-squared tests were calculated to examine whether receiving eye drop education varied by patient or provider characteristics ($\alpha = .05$). We calculated exact Mann–Whitney rank-sum tests to assess whether receiving technique education resulted in improved eye drop technique at the subsequent office visit ($\alpha = .05$).

Results

Sample characteristics

Eighty-six percent ($n = 279$) of eligible patients participated in the study (Table 2). Patients who were lost to follow-up ($n = 21$) at the 8-month follow-up visit were significantly less likely to have health insurance than patients who were insured (Pearson $\chi^2 = 12.9$, df = 1, $p < .001$).

Ten of the 15 providers were male (67%). Fourteen providers were White and one was African American. Provider age ranged from 26 to 66 years (mean 40.8 years, $SD = 11.7$ years). Eighty percent of providers ($n = 12$) were glaucoma specialists. The average years since graduation from medical school was 12.2 years ($SD = 11.4$ years, range = 1–38 years).

Methods of education about eye drop technique

Table 3 summarizes the methods providers used to educate patients about eye drop technique. Only 94 patients (34%) received education on eye drop technique at either visit. Among patients who were new to eye drops ($n = 51$), less than half received education at the baseline visit. Providers educated patients about technique at the baseline visit more often than at the 4- to 6-week visit. Across both time points, in total 85 patients (31%) received verbal education and 27 patients (10%) received education that involved a visual technique demonstration. Written materials were only used one time at the patient's request.

At the baseline visit, 194 (70%) patients did not receive any method of eye drop technique education, while 39 (14%) received one method, 31 (11%) received two methods, and 11 (4%) received three methods. At the 4- to 6-week follow-up visit, 226 (81%) patients did not receive any method of eye drop technique education, while 29 (10%) received one method, 7 (3%) received two methods, and 1 (0.4%) received three methods.

Types of education about eye drop technique analyzed by patient and provider characteristics

Patients who were newly prescribed glaucoma medications at the baseline visit (Pearson $\chi^2 = 7.10$, df = 1, $p = .008$) and patients who asked at least one question about eye drop

administration at either visit (Pearson $\chi^2 = 30.52$, df = 1, $p < .001$) were more likely to receive technique education than patients who were already taking glaucoma medications and patients who did not ask any technique questions, respectively.

Two providers did not educate any of their glaucoma patients about eye drop administration. These two providers appeared demographically similar to the 13 providers who provided technique education to at least one of their patients.

The Relationship between education and change in patient eye drop technique

There were no significant associations between change in eye drop technique (worse, no change, improved) and whether technique education was provided at the previous visit (Table 4).

Discussion

This study used videotape recordings of glaucoma office visits and patient eye drop technique to examine whether patients who received any eye drop technique education demonstrated better technique at a subsequent visit. Our hypothesis that patients who received technique education would demonstrate improved eye drop technique over time was not supported. However, the limited frequency with which providers educated about eye drops reduced our power to detect a significant effect.

We were surprised that patients who received eye drop technique education during a glaucoma office visit did not demonstrate improved technique at a subsequent visit. Self-Regulation Theory (Clark et al., 2001) posits that technical support from providers can increase patients' knowledge and self-efficacy, which may ultimately improve medication taking and other self-management behaviors. One possible reason education was not related to patient technique in our sample could be because providers asked patients to demonstrate technique in fewer than 6% of office visits. Technique demonstrations have been shown to improve inhaler technique for patients with chronic respiratory diseases (Bosnic-Anticevich et al., 2010; Dantic, 2014) and may also be an effective teach-back method for improving eye drop technique (Muir & Lee, 2010; Robin et al., 2010). Because patients are often unaware that they have incorrect technique (Stone et al., 2009), in order to accurately determine which patients have difficulty with drop administration, providers may need to demonstrate correct technique and then directly observe patient technique. Alternatively, providers could ask patients to verbally walk through the process of instilling drops; however, with a physical skill like administering eye drops, patients may be able to verbally articulate the process even though they cannot physically execute correct technique. Future studies should determine whether verbal or physical teach-back methods are equally effective at improving patient eye drop technique.

Over the period of two office visits, only 34% of patients in our sample were educated by their providers about how to administer eye drops. Additionally, only 47% of patients who were new to taking eye drops received education at their baseline visits. Previous studies found that between 19% and 58% of patients reported receiving technique education (Schwartz et al., 2013; Tatham et al., 2013), suggesting that greater understanding is needed

as to why providers do not teach eye drop technique to their glaucoma patients. Specifically, an examination of whether environmental factors (e.glack of time; technician provides education), interpersonal factors (e.g., patient and provider do not openly communicate about technique), or intrapersonal factors (e.g., providers and patients believe that the patient already knows how to use drops correctly) differentially influence provider educational behavior would be informative.

As there is no current preferred method or guideline for teaching patients eye drop technique, future investigations of which methods are most effective at improving and maintaining correct patient technique are warranted. Our study was not aimed at determining which verbal and nonverbal methods were most effective at improving patient technique, or at rating the quality of provider communication and education. However, a prospective controlled trial that randomizes patients to receive different types of education may help identify which forms of education are associated with improved technique.

Patients who were new to drops and patients who asked questions about technique were more likely to receive education. Additional analyses from this data set found that patients who were newly prescribed eye drops were more likely to ask questions during their office visit, which may, in turn, prompt providers to educate about technique (Sleath et al., 2014).

More research is needed to understand (a) whether some patients have a technique ceiling, that is, whether there are some steps that they cannot master despite repeated educational attempts and practice (perhaps due to physical limitations like arthritis) (Winfield et al., 1990); and (b) whether some steps cannot be taught verbally. Patients' techniques may improve immediately after receiving education but then deteriorate over a short period of time. An investigation to determine the number and optimal spacing of educational sessions is an important area for future research. Patients who are unable to instill drops correctly after repeated educational attempts may benefit from (a) having someone else, if available, instill drops for them, (b) learning alternative methods for instilling drops (Ritch, Jamal, Gürses-Özden, & Liebmann, 2003), (c) mechanical aids and devices that facilitate drop instillation, or (4) considering laser or surgical interventions (Letocha, 1985).

Limitations

This study has several limitations and results should be interpreted with caution. Most patients in this sample were not new to eye drops and may have received education at a previous visit, which could account for both the low frequency with which education was provided and patients' above-average competency with instilling drops. Less than half of patients who were new to drops received education, so we had limited power to examine the effects of education in the subset of patients who were most likely to benefit from it. Moreover, because education and technique improvement occurred infrequently, we had limited power to explore whether other variables, such as the patient's glaucoma severity, health literacy, and self-efficacy, moderated the effect of education on technique improvement. Providers and patients both knew the visit was being recorded, but they did not know the study hypotheses. Even if there was a Hawthorne effect, it was likely small (Penner et al., 2007), as providers only educated one-third of their patients about technique. Study staff did not track the characteristics of patients who declined to speak with the

research assistant. However, patients in our sample demonstrated deficiencies in technique and self-efficacy levels that are similar to other studies (Hennessy et al., 2010; Schwartz et al., 2013; Stone et al., 2009); thus, we believe the effect of selection bias may be minimal. Additionally, the shape and size of the eye drop bottle that patients used to demonstrate technique may have been different from the bottle they typically use. The quality of the technique videotapes also resulted in missing or unclear data; many patients blocked the camera while demonstrating technique. Also, the use of a single coder to code eye drop technique videos was a limitation. Lastly, patients may have received technique education elsewhere (e.g., pharmacies, online, family). Despite these limitations, the study presents new information on the effects of provider eye drop technique education.

Proper use of topical glaucoma medications is a complex issue that is affected by environmental, regimen-related, patient-level, and provider-level factors (Tsai, McClure, Ramos, Schlundt, & Pichert, 2003). Administering eye drops correctly is an important component of glaucoma medication use, yet many patients, including nearly half of patients who were newly prescribed drops, were not instructed in how to instill their eye drops. Providers most commonly used verbal instruction to teach patients how to use their eye drops, and this form of education did not lead to sustained improvements in patient technique. Future research should evaluate the effectiveness of different methods for teaching technique, including teach-back methods, as this can inform future evidence-based practice recommendations.

Funding

This work was supported by grant EY018400 from the National Eye Institute (Sleath, PI) and by grant UL1TR001111 from the National Center of Research Resources, National Institutes of Health (NIH). NIH had no role in the design or conduct of this research. Dr. Carpenter's salary was partially supported by the National Center for Research Resources and the National Center for Advancing Translational Sciences, National Institutes of Health, through grant KL2TR000084. Dr. Muir receives salary support from a VA HSR&D career development award. Dr. Hartnett was also supported by NIH/NEI EY015130 and EY017011. The sponsor or funding organization had no role in the design or conduct of this research.

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Table 1.

Definitions and Examples of the Six Methods of Provider Eye Drop Technique Education.

Educational method	Definition	Example provider quotations
Patients whose provider provided point-by-point instruction about how to use eye drops	A discussion about how to administer eye drops correctly with specific teaching points	"When we have you put in eye drops, we recommend that you wash your hands before you do it. Keep a real clean area. Don't, you know, start, I don't know—in the bottom of your kitchen sink or something. I tell people that if you bring your chin up and keep your eyes kind of flat and look up, you have a better aim, ok, and you have taken drops before."
Patients whose provider discusses eye drop administration but does not include point-by-point instruction	A brief discussion that eye drops need to be administrered correctly that does not include specific teaching points.	"Ok. Then the last thing to tell you is just to make, sure you're put [*sic*] it in correctly." "The other thing that you should be aware of is how to put the drop in because drops are hard."
Provider asked patient to demonstrate how to use eye drops	Patient demonstrates eye drop technique to provider.	"Um, why don't you show me how you put it in? What do you do?"
Patient's provider demonstrated how to use eye drops	Provider demonstrates eye drop technique to patient.	"You want to hold your head back put actually I'm going to put the top on I don't want to put a drop in my eye now." (*Doctor then demonstrates how to use.*)
Patient watched video about how to use eye drops	Provider has patient watch a video about how to administer eye drops correctly.	—
Patient received written information about how to use eye drops	Provider gives patient written materials (e.g., brochures) about how to administer eye drops correctly.	Patient: "I would like to know if there was any kind of reading material that I could have. That I could um find out about it." Provider: "Ok. We'll get you some."

Table 2.

Patient Characteristics ($N = 279$).

	Percent (*N*)
Male	41 (114)
Race	
African American	36 (99)
Non-African American	64 (179)
Newly prescribed glaucoma medications	18 (51)
Glaucoma severity (worse eye)	
Mild	62 (162)
Moderate	21 (55)
Severe	17 (45)
Glaucoma severity (better eye) *	
Mild	78 (217)
Moderate	8 (21)
Severe	10 (45)
Arthritis diagnosis	36 (100)
Reading level	
Less than or equal to third grade	1 (3)
Fourth to sixth grade	3 (9)
Seventh to eighth grade	10 (29)
More than eighth grade	84 (233)
Age (years)	
Mean (*SD*), range	65.8 (12.8), 21–93
Years of education	
Mean (*SD*), range	15.1 (3.5), 5–26
Has health insurance	98 (272)
Eye drop self-efficacy	
Mean (*SD*), range	16.7 (2.0), 6–18
Patient asked at least one question about eye drop administration at either visit	17 (44)

* Percentages do not add to 100% due to missing data.

Table 3.

Frequency of Eye Drop Technique Education at Baseline and 4- to 6-Week Follow-Up Visit.

	Patients who were not new to drops		Patients who were new to drops	
Method of education provided	**Baseline visit (*n* = 228), % (*N*)**	**4- to 6-week visit (*n* = 216), % (*N*)**	**Baseline visit (*n* = 51), % (*N*)**	**4- to 6-week visit (*n* = 47), % (*N*)**
Patients whose provider provided point-by-point instruction about how to use eye drops	12 (27)	3 (6)	26 (13)	2 (1)
Patients whose provider discusses eye drop administration but does not include point-by-point instruction	22 (49)	8 (19)	45 (23)	13 (6)
Provider asked patient to demonstrate how to use eye drops	6 (14)	5 (11)	4 (2)	4 (2)
Patient's provider demonstrated how to use eye drops	1 (2)	0 (0)	6 (3)	0 (0)
Patients watched video about how to use eye drops	0 (0)	0 (0)	0 (0)	0 (0)
Patient received written information about how to use eye drops	0 (0)	0 (0)	2 (1)	2 (1)
Patients who received at least one method of eye drop technique education	25 (57)	13 (29)	47 (24)	17 (8)
Patients who did not receive any method of eye drop technique education	75 (167)	87 (187)	53 (27)	83 (39)

Note. Some patients received more than one method of eye drop technique education, so the totals for the individual methods of eye drop technique education are not equal to the number of patients who received at least one method of eye drop technique education.

Table 4.

Change in Eye Drop Technique at 4- to 6 Week Visit and 8-Month Follow-Up Visit.

	4- to 6-week technique, % (*N*)			8-month technique, % (*N*)		
	Worse	**No change**	**Improved**	**Worse**	**No change**	**Improved**
Patient tilts head back while sitting, standing, or lying down						
Educated at previous visit	0 (0)	100 (66)	0 (0)	3 (1)	100 (29)	0 (0)
Not educated at previous visit	2 (3)	98 (166)	0 (0)	2 (3)	98 (179)	0 (0)
Patient directs bottle toward eye						
Educated at previous visit	0 (0)	100 (67)	0 (0)	0 (0)	100 (30)	0 (0)
Not educated at previous visit	0 (0)	100 (170)	0 (0)	0 (0)	100 (185)	0 (0)
Patient squeezes bottle to produce a single drop						
Educated at previous visit	6 (2)	88 (28)	3 (2)	0 (0)	94 (15)	6 (1)
Not educated at previous visit	1 (1)	99 (83)	0 (0)	2 (2)	98 (101)	0 (0)
Drop lands in eye on first attempt						
Educated at previous visit	2 (1)	94 (59)	5 (3)	10 (3)	86 (25)	3 (1)
Not educated at previous visit	4 (7)	90 (147)	6 (9)	6 (10)	89 (158)	6 (10)
Patient instills a single drop						
Educated at previous visit	14 (5)	58 (21)	28 (10)	19 (3)	81 (13)	0 (0)
Not educated at previous visit	16 (19)	70 (83)	14 (16)	10 (13)	74 (98)	16 (21)
Patient touches any part of eye or face with bottle						
Educated at previous visit	13 (5)	74 (28)	13 (5)	3 (1)	75 (18)	21 (5)
Not educated at previous visit	11 (15)	76 (104)	9 (18)	7 (15)	76 (117)	15 (23)
Patient performs nasolacrimal occlusion						
Educated at previous visit	2 (1)	94 (63)	5 (3)	0 (0)	97 (29)	3 (1)
Not educated at previous visit	2 (4)	83 (161)	2 (4)	3 (5)	97 (179)	1 (1)

Note. Changes in technique scores were calculated listwise; due to unclear videotapes, numbers vary by step.