Impact of the Support, Educate, Empower Personalized Glaucoma Coaching Program Pilot Study on Eye Drop Instillation Technique and Self-Efficacy

Kevin J. Schneider, MA,1 Cecilia N. Hollenhorst, BA,1 Autumn N. Valicevic, MS,1 Leslie M. Niziol, MS,1 Michele Heisler, MD, MPA,2 David C. Musch, PhD, MPH,1,3 Stephen M. Cain, PhD,4 Paula-Anne Newman-Casey, MD, MS1

Purpose: To assess the Support, Educate, Empower (SEE) personalized glaucoma coaching program impact on (1) eye drop instillation technique and (2) eye drop instillation self-efficacy.

Design: Prospective pre-post pilot study.

Participants: Patients with a diagnosis of glaucoma or ocular hypertension taking ≥1 glaucoma medication, ≥40 years old, spoke English, self-administered their eye drops, and ≤80% adherent to their glaucoma medication by electronic monitoring.

Methods: Eye drop administration was video recorded before the first SEE in-person coaching session, which included teaching eye drop instillation techniques using a motivational interviewing-based approach. At the third and final in-person counseling session 6 months later, eye drop administration was video recorded. Participants’ self-efficacy was assessed using the validated Eye Drop Technique Self-Efficacy Scale (EDTSES) survey at baseline and 1 month after completion of the program. Before and after intervention videos were assessed by an observer masked to time point. Before versus after intervention comparisons were made using McNemar’s and paired t tests.

Main Outcome Measures: The main outcome was change in participants’ eye drop instillation technique as measured by (1) accuracy of an eye drop landing on the eye, (2) ability to instill an eye drop on the first attempt, and (3) contaminating the bottle by contact with ocular surface, eyelashes, and skin. The secondary outcome measure was before versus after change in the EDTSES score (6 items, each assessed on a 3-point Likert scale, with higher scores indicating better self-efficacy).

Results: Thirty-nine participants completed the SEE intervention, 38 with before and after EDTSES scores and 31 with video recordings. Six of 31 participants instilling drops outside the eye before intervention improved their technique after intervention, whereas 2 participants worsened (P = 0.157). From before to after intervention, participants demonstrated significant improvement in not touching the ocular surface (P = 0.046), the eyelashes (P = 0.020), or the skin (P = 0.025) with the bottle tip. A significant increase was found in eye drop instillation self-efficacy from an average score of 2.6 (standard deviation [SD], 0.3) to 2.8 (SD, 0.2) on the EDTSES score (P = 0.007).

Conclusions: The SEE program significantly decreased eye drop bottle contamination, increased eye drop instillation self-efficacy, and demonstrated an insignificant increase in ability to instill drops successfully and accurately. Ophthalmology Glaucoma 2021;4:42-50 © 2020 by the American Academy of Ophthalmology

Supplemental material available at www.ophthalmologyglaucoma.org.

Correct eye drop instillation is a critically important and modifiable component of effective glaucoma medication use. Even if a patient maintains a strict adherence schedule, it is for naught if eye drop instillation technique is poor. Previous studies show that one quarter of patients’ attempts to instill drops miss the eye entirely.1,2 Between 20% and 80% of patients contaminate the eye drop bottle by contacting the ocular surface, adnexa, or face.3-4 As a result of poor self-administration technique, these patients are more likely to experience substantial glaucomatous vision loss5-6 that can lead to decreased quality of life7-9 and increased risk for traumatic events such as falls or motor vehicle accidents.10 This study was designed to assess a new method to teach eye drop instillation technique.

Educational tactics, mechanical devices, and reminder interventions designed to improve eye drop application have been assessed independently, and reported in the literature, with widely varying results.11-16 Promising results for
reduction in contamination have been shown with some medical devices, but devices present additional challenges to patients, including access, correct use, and overall usability.\textsuperscript{15,17} Generally, multifaceted approaches have shown the most promise for improving eye drop instillation technique. In one study, participants viewed an instructional video and a diagram, and in another study, participants were video recorded while self-instilling drops and then received constructive feedback from their physician.\textsuperscript{18,19} Outcomes using these approaches were promising. However, the outcomes were measured directly after the intervention on the same day. These studies did not examine whether the patient continued to demonstrate longer-term competence or improved self-efficacy, both important considerations for successful medication adherence in a chronic disease like glaucoma.\textsuperscript{20}

Personalized counseling interventions are multifaceted, go beyond technique instruction alone, and have promise in improving patient self-efficacy and skills to overcome barriers to adherence.\textsuperscript{21–23} Counseling based on motivational interviewing (MI), a patient-centered approach that helps people to explore personal motivations for positive health behaviors, has been found to be very effective in improving adherence to medication regimens in conditions such as diabetes and hypertension.\textsuperscript{24–28} To our knowledge, no studies to date have measured objectively the impact of using personalized MI-based counseling to teach eye drop instillation. The purpose of this pilot study was to evaluate if using an MI-based approach to teach eye drop instillation as part of the Support, Educate, Empower (SEE) personalized glaucoma coaching program improved: (1) the accuracy of an eye drop landing on the eye, (2) the ability to instill an eye drop on the first attempt, and (3) the ability to avoid contaminating the bottle. We additionally assessed whether patient self-efficacy related to instillation of eye drops changed after participating in the SEE program.

Methods

Study Sample

The SEE program was a 7-month personalized glaucoma coaching program whose overarching aim was to improve glaucoma medication adherence. Recruitment for the SEE program took place at the main tertiary care eye center at the University of Michigan and 10 satellite ophthalmology clinics. Eligible patients included those who had a glaucoma diagnosis (including glaucoma suspect and ocular hypertension), were \textgreater{}=40 years of age, took \textgreater{}=1 glaucoma medication, and spoke English. These patients were sent a letter with an option to opt out of recruitment. Those who had a diagnosis of a severe mental illness (defined as a diagnosis of bipolar disorder, schizophrenia, or depressive episode with psychosis) or cognitive impairment (defined as a diagnosis of dementia or memory loss) were excluded from the study. Individuals who met these inclusion and exclusion criteria were called, and if interested in study participation, they were administered 2 validated scales assessing medication adherence and were questioned about whether they instilled their own eye drops. The Chang Adherence Measure is a single-item assessment of glaucoma medication adherence that asks, “Over the past month, what percentage of your drops do you think you took correctly?” The Morisky Medication Adherence Scale is an 8-item medication adherence scale in which a higher score represents better adherence. Those who self-reported adherence of \textless{}95% on the Chang Adherence Measure\textsuperscript{29} had a score of \textless{}6 on the Morisky Medication Adherence Scale\textsuperscript{30} and who self-instilled eye drops were invited to undergo a 3-month baseline monitoring period during which glaucoma medication adherence was measured with electronic monitors (AdhereTech, New York, NY).\textsuperscript{21} Forty-eight patients (51% of the 95 who completed monitoring) showed a baseline adherence score of \textless{}80% and were deemed eligible for the SEE program intervention. Thirty-nine of the 48 eligible participants completed the 7-month SEE program. The 38 participants completed the Eye Drop Technique Self-Efficacy Scale (EDTSES) at baseline and then again 1 month after the glaucoma counseling program had ended. Before and after intervention video recordings of participants self-administering eye drops were obtained for 31 of these participants. Data were missing because some videos were obtained only before (n = 3) or after (n = 3) the intervention because of errors in uploading the video to the secure storage server, and some videos were lost because of technological error (n = 2). A detailed overview of participant study flow is presented in Figure 1. The SEE program pilot study (ClinicalTrials.gov identifier, NCT03159247) was approved by the University of Michigan Institutional Review Board and adhered to the tenets of the Declaration of Helsinki. All participants provided written informed consent.

Figure 1. Flow diagram for study population showing the number of participants at exclusion points and the number of participants lost to follow-up. The numbers of participants are included for each point of dropout. EDTSES = Eye Drop Technique Self-Efficacy Scale; SEE = Support, Educate, Empower.
Support, Educate, Empower Program

The SEE program was designed to address and improve patient eye drop adherence using team-based care, wherein a trained health coach uses an eHealth tool (www.glaucomaeysguide.org) to deliver personalized glaucoma education and counseling. The SEE program is a personalized glaucoma counseling program focused on improving all aspects of glaucoma medication adherence, including the ability to instill eye drop medications accurately and effectively.24 In brief, the SEE program consisted of 8 meetings between a trained glaucoma counselor and the participant (3 in-person meetings and 5 between-visit phone calls for follow-up support). The educational material in the SEE program is personalized through a web-based tool so that the counselor can offer education about the participant’s particular glaucoma diagnosis, test results, doctor’s recommendations, and barriers to optimal medication adherence. The counselor uses MI-based counseling to identify the patient’s specific barriers to adherence and to brainstorm constructive solutions collaboratively. The SEE program is described in detail in a previous publication.21

Eye Drop Technique Instruction

During the first in-person counseling sessions, the glaucoma counselor used the SEE web-based personalized educational tool to teach the participant about eye drop instillation. Participants could choose to go over eye drop instillation again with the coach at the second and third in-person visit if they wanted to; all participants chose to go over eye drop instillation again at the second in-person visit and none of the participants chose to go over it at the third visit. Eye drop instillation was taught using an elicit-provide-elicit method of communication. Elicit-provide-elicit is a component of MI that establishes what the patient already knows by asking the patient to demonstrate how they instill the eye drops, asks permission to provide advice, shows 2 new ways of instilling eye drops through a visual display, and then asks the patient to demonstrate their new eye drop instillation technique to see whether and how the new information has helped them. The information the counselor provided on how to instill eye drops was based on national guidelines and included important points such as hand washing, contamination prevention, and accurate delivery of a single drop to the eye.22 Visuals and prompts for common challenges to proper technique were included onsite for the counselor and participant to work through together. Participants were given access to the eye drop instructional materials after the counseling session through both a printed handout and a login and password for the website to access the web-based materials.

Assessments

Participant eye drop instillation was video recorded before and after the intervention. The before intervention video was recorded before any instruction was given during the intervention. The after intervention video was recorded after the intervention. The before intervention video was recorded before the second coaching session. Two months later at the 6-month visit, the after intervention video was recorded after the final in-person coaching session. No participants received eye drop instillation coaching at this session. Videos were recorded for both eyes of a participant and for as many attempts as participants made, although correct instillation of eye drops was not always achieved.

One trained investigator (K.J.S.) masked to time point analyzed all videos and scored each participant’s eye drop technique according to the techniques of Hennessy et al.33 Eye drop technique was scored as follows: number of attempts to instill 1 eye drop in the eye correctly, location of first drop attempt (ocular surface, eyelid, canthus, skin surrounding the eye), number of drops instilled into eye, and touch between the bottle tip and the ocular surface, eyelashes, or skin. The primary outcome was determining if the intervention produced change in participants’ eye drop instillation techniques as measured by (1) accuracy of an eye drop landing on the ocular surface (as opposed to skin outside the eye), (2) ability to instill an eye drop on the first attempt, and (3) contaminating the bottle by contact with the ocular surface, eyelashes, or skin outside of the eye. If an eye drop landed partially in and outside of the eye, it was considered to be outside the eye.

At the baseline study visit before the SEE counseling program, participants completed a questionnaire that included the EDTSES. The EDTSES is a 6-item scale developed and validated in conjunction with the 10-item Glaucoma Adherence Self-Efficacy Scale (Cronbach’s α, 0.91 for all 14 items) that assesses participants’ self-confidence in their ability to administer their eye drops.24,34 The EDTSES assesses eye drop self-efficacy using 6 items asking about participant confidence with instilling their eye drops, each scored on a 3-point Likert scale from 1 (not at all confident), to 2 (somewhat confident), to 3 (very confident).24 The scale is scored as a mean of the 6-item responses, with higher scores indicating higher self-efficacy. The EDTSES was administered again as part of a survey 1 month after completion of the SEE program.

Statistical Analysis

Demographic characteristics of the participant sample were summarized with descriptive statistics including means, standard deviations (SDs), frequencies, and percentages. Eye drop technique accuracy and contamination measures were aggregated to the participant-level by using the worse application between eyes on the first instillation attempt. For example, if a participant contaminated the bottle tip by touching the ocular surface in one eye and not the other eye on the first instillation attempt, the participant would be classified as contaminating the bottle tip to the ocular surface. The ability to instill an eye drop on the first attempt was measured by using the best attempt in either eye. The number of attempts needed to instill an eye drop to the eye correctly was measured by looking at the minimum number of attempts made to instill the eye drop in either eye correctly. Change in these measures was assessed using McNemar chi-square tests for paired data. The mean EDTSES scores from before and after the SEE program were compared using a paired t test. Individual responses to the 6 items of the EDTSES also were compared before and after the SEE intervention using McNemar chi-square tests for paired data. For this analysis, individual questions on the EDTSES were collapsed into 2 categories: not at all confident or somewhat confident and very confident, because very few participants reported being not at all confident across all survey questions (Table S1, available at www.ophthalmologyglaucoma.org).

The association between change in EDTSES score and change in accuracy of video recorded eye drop technique before to after intervention also was assessed. Each eye drop technique outcome measure (accuracy, instilled eye drop correctly on first attempt, and contamination) was categorized for the change observed from before to after SEE program intervention. These changes were categorized as follows: improvement in technique, not proficient before intervention and proficient after intervention; worsening technique, proficient to not proficient; proficient, no change in technique, where proficient at both times before and after intervention; and not proficient, no change in technique, where not proficient at both times before and after intervention. Mean EDTSES scores changes were compared between these accuracy change groups using the analysis of variance when the number of groups was more than 2 and using t tests when the number of
groups was 2. All analyses were performed with SAS software version 9.4 software (SAS Institute, Carey, NC).

Results

Table 1 shows the demographics of the participant sample for both those who completed EDTSES surveys and those who completed instillation videos and EDTSES surveys. A total of 38 participants completed the SEE program and the baseline EDTSES and the EDTSES 1 month after the end of the intervention. Of the 38 participants, 45% (n = 17) were women, 43% (n = 16) were White, 8% (n = 3) had less than a high school education, and 24% (n = 8) reported a yearly income of <$25,000 per year. On average, participants were 64 years of age (SD, 10.8 years). Thirty-one participants completed both the before and after video analyses. The 31 participants represented a similar range of demographic characteristics: 42% (n = 13) were women, 40% (n = 12) were White, 10% (n = 3) had less than a high school education, and 21% (n = 6) reported a yearly income of <$25,000 per year. On average, the 31 participants were 62 years of age (SD, 10.7 years). No significant demographic differences were found between the participants who completed the EDTSES survey and instillation videos (n = 31) and the participants who did not complete instillation videos (n = 7).

Accuracy of Instilling Eye Drops in the Eye

Six (19%) participants’ eye drop instillation accuracy improved after the program: they instilled an eye drop outside of the eye before intervention, but not after intervention (P = 0.157; Table 2). Conversely, 2 (6%) participants’ eye drop instillation accuracy worsened after the program because of instilling an eye drop inside the eye before intervention but not doing so after intervention. The remaining participants showed no change in eye drop installation accuracy; 6 (19%) instilled the eye drop outside the eye at both time points and 17 (55%) instilled the eye drop correctly at both time points.

Number of Attempts Needed to Instill an Eye Drop

During the video recording before intervention, 26 of 31 participants (84%) needed just 1 attempt to place the eye drops into either of the eyes, 2 (6%) needed 2 attempts, 1 (3%) needed 3 attempts, and 2 (6%) did not place the drop into the eyes at all. In the recordings after the intervention, 29 of 31 participants (94%) needed only 1 attempt to place the eye drops into either eye, and 2 participants (6%) needed 2 attempts, but still did not instill a drop into the eye. No participant dispensed more than 1 drop on any single attempt. Five participants (16%) were not able to instill an eye drop on the first attempt before the SEE intervention, but were able to after the SEE intervention. The technique of 2 participants (6%) worsened after the SEE program: they instilled an eye drop on the first attempt before intervention and were not able to do so after the intervention (P = 0.257). The remaining participants (n = 24 [77%]) successfully instilled a single drop in the eye both before and after intervention (Table 2).

Bottle Contamination

All assessments of bottle contamination improved significantly after participating in the SEE program. Four participants (13%) touched the bottle tip to the ocular surface before intervention, but did not after intervention. No participants demonstrated the converse by not touching the ocular surface before the program and contaminating the bottle tip after the SEE program (P = 0.046; Table 2).

### Table 1. Demographic Characteristics of Sample Participants

<table>
<thead>
<tr>
<th>Demographic Characteristics</th>
<th>Completed Instillation Videos and Eye Drop Technique Self-Efficacy Scale Survey (n = 31)</th>
<th>Completed Eye Drop Technique Self-Efficacy Scale Survey (n = 38)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yrs), mean (SD)</td>
<td>62 (10.7)</td>
<td>64 (10.8)</td>
</tr>
<tr>
<td>Race, no. (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>12 (40)</td>
<td>16 (43)</td>
</tr>
<tr>
<td>Black</td>
<td>15 (50)</td>
<td>18 (49)</td>
</tr>
<tr>
<td>Other</td>
<td>3 (10)</td>
<td>3 (8)</td>
</tr>
<tr>
<td>Gender, no. (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>18 (58)</td>
<td>21 (55)</td>
</tr>
<tr>
<td>Female</td>
<td>13 (42)</td>
<td>17 (45)</td>
</tr>
<tr>
<td>Education, no. (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than high school</td>
<td>3 (12)</td>
<td>3 (8)</td>
</tr>
<tr>
<td>High school diploma</td>
<td>4 (13)</td>
<td>4 (11)</td>
</tr>
<tr>
<td>Some college</td>
<td>10 (32)</td>
<td>12 (32)</td>
</tr>
<tr>
<td>College degree</td>
<td>5 (16)</td>
<td>8 (21)</td>
</tr>
<tr>
<td>Graduate degree</td>
<td>9 (29)</td>
<td>11 (29)</td>
</tr>
<tr>
<td>Income ($), no. (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;25 000</td>
<td>6 (21)</td>
<td>8 (24)</td>
</tr>
<tr>
<td>25 000–50 000</td>
<td>12 (43)</td>
<td>14 (41)</td>
</tr>
<tr>
<td>51 000–100 000</td>
<td>7 (25)</td>
<td>7 (21)</td>
</tr>
<tr>
<td>&gt;100 000</td>
<td>3 (11)</td>
<td>5 (15)</td>
</tr>
</tbody>
</table>

SD = standard deviation.
Eye Drop Technique Self-Efficacy Scale

The average score on the EDTSES increased significantly from 2.6 (SD, 0.3) at baseline to 2.8 (SD, 0.2) after the intervention (P = 0.001; Table 2). When analyzing each individual item from the EDTSES, confidence in “consistently getting the right amount of eye drop medication in your eye each time you use it” (EDTSES question 3; P = 0.021), and “delivering the required amount of eye drops to the eye without missing or applying too much medication” (EDTSES question 5; P = 0.003) showed the largest percentage of participants reporting improved confidence after the intervention. None of the other questions showed significant improvements before or after the intervention.

Table 2. Video-Recorded Eye Drop Installation Accuracy and Contamination before Intervention and after Intervention

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Remained the Same</th>
<th>Improved*</th>
<th>Worsened*</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Not Proficient</td>
<td>Proficient</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drop instilled</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outside the eye</td>
<td>6 (19)</td>
<td>17 (55)</td>
<td>6 (19)</td>
<td>2 (6)</td>
</tr>
<tr>
<td>On first attempt</td>
<td>0 (0)</td>
<td>24 (77)</td>
<td>2 (6)</td>
<td>5 (16)</td>
</tr>
<tr>
<td>Bottle contamination</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>With ocular surface</td>
<td>0 (0)</td>
<td>27 (87)</td>
<td>4 (13)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>With eyelashes</td>
<td>0 (0)</td>
<td>22 (71)</td>
<td>8 (26)</td>
<td>1 (3)</td>
</tr>
<tr>
<td>With skin</td>
<td>0 (0)</td>
<td>26 (84)</td>
<td>5 (16)</td>
<td>0 (0)</td>
</tr>
</tbody>
</table>

Data are frequency (%) unless otherwise indicated.
*“Worsened” denotes individuals who were proficient at the particular skill before intervention but not after intervention, and “Improved” denotes individuals who were not proficient at the particular skill before intervention but were after intervention.

Table 3. Eye Drop Technique Self-Efficacy Scale Scores before and after Intervention

<table>
<thead>
<tr>
<th>Question: How Confident Are You That You Can Carry out the Following Tasks?</th>
<th>Remained the Same</th>
<th>Improved*</th>
<th>Worsened*</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Confident</td>
<td>Not Confident</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Squeezing your eye drop bottle</td>
<td>35 (95)</td>
<td>0 (0)</td>
<td>2 (6)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>2. Placing the medication drop(s) in your eye</td>
<td>29 (76)</td>
<td>0 (0)</td>
<td>7 (19)</td>
<td>2 (5)</td>
</tr>
<tr>
<td>3. Consistently placing the right amount of eye drop medication in your eye each time you use it</td>
<td>12 (33)</td>
<td>12 (33)</td>
<td>10 (28)</td>
<td>2 (6)</td>
</tr>
<tr>
<td>4. Correctly angling your head to apply eye drop(s) accurately</td>
<td>19 (51)</td>
<td>3 (8)</td>
<td>11 (30)</td>
<td>4 (11)</td>
</tr>
<tr>
<td>5. Delivering the required amount of eye drop(s) to the eye without missing or applying too much</td>
<td>10 (26)</td>
<td>12 (32)</td>
<td>14 (37)</td>
<td>2 (5)</td>
</tr>
<tr>
<td>6. Not touching your eye with the eye drop bottle</td>
<td>21 (55)</td>
<td>5 (13)</td>
<td>7 (18)</td>
<td>5 (13)</td>
</tr>
</tbody>
</table>

EDTSES = Eye Drop Technique Self-Efficacy Scale; SD = standard deviation.

Table 4 shows the average change in mean EDTSES score from before to after SEE program intervention by categorical change in each eye drop instillation accuracy change measure. Although no significant differences were found in mean EDTSES score across groups for any of the eye drop instillation accuracy or bottle tip contamination measures, the trends were nearly all in the appropriate directions, demonstrating an association between the improvement in EDTSES score and the improved eye drop instillation behavior. For example, for those whose technique improved and who no longer instilled an eye drop outside the eye after the SEE program (n = 6), their EDTSES score...
increased by 0.06 (SD, 0.5). Conversely, for those whose technique worsened after the SEE program and who instilled a drop only outside the eye after the program (n = 2), the EDTSES score decreased by 0.08 (SD, 0.6; Table 4). The only category for which the trend was in the opposite direction was the assessment of whether participants were able to instill an eye drop into the eye on the first attempt. The EDTSES score decreased (~0.03) for those whose accuracy improved (n = 2; SD, 0.3) and the EDTSES score increased (0.17) for those whose accuracy worsened (n = 5; SD, 0.2; Table 4).

**Discussion**

After completing the 7-month SEE program, the 31 participants demonstrated a significant decrease in bottle tip contamination and a significant improvement in eye drop instillation self-efficacy. Participants’ confidence in delivering the correct amount of medication—neither too much nor too little—showed the most improvement of all the self-efficacy items after SEE program participation. Participants also demonstrated improved accuracy of eye drop instillation (the drop landing outside the eye vs. on the ocular surface): 6 (19%) improved whereas only 2 (6%) worsened (P = 0.157). Additionally, after SEE program participation, 5 participants (16%) improved in their ability to instill an eye drop on the first attempt compared with 2 participants (6%) whose instillation technique worsened (P = 0.257).

In a nationwide study of 279 doctor–glaucoma patient interactions, the frequency and type of eye drop instillation education given was assessed, and the investigators found that only 31% of patients received verbal education and 10% received visual education. The visual education involved either the provider watching the patient instill the eye drops or the patient watching the provider instill eye drops. None of this education had an impact on eye drop instillation technique 8 months later. In contrast, our study highlights the potential benefit of a standardized yet personalized educational approach to teaching eye drop instillation.

In light of a nationwide push for medical institutions to be more scrupulous with resources, a need exists to assess whether in-person education or counseling adds value over paper-based or web-based education, because not all educational interventions are effective for improving eye drop technique. McVeigh and Vakros demonstrated that instructional charts alone can improve patient hand hygiene in preparation for instilling eye drops. However, they showed no improvement for instilling 1 eye drop to the eye on first attempt or for preventing contamination. Patients who struggled with the chart described it as difficult to read, interpret, and apply to their own technique. Results from studies using video education show promise. Feng et al reported improvement in average eye drop technique, but showed no reduction in contamination after the combined educational video and chart intervention. A recent randomized control trial by Davis et al included a 4-minute glaucoma eye drop technique educational video. Technique was defined as a single variable ranging from 0 to 5, with 5 total steps, including instilling a single drop, holding the eye lid open with fingers, placing 1 drop accurately onto the eye, not touching the bottle tip to the eye or face, and closing the eye for 1 minute after instillation. Significant improvement in technique was found immediately after the video and 1 month later.

Educational videos can play a pivotal role in improving eye drop technique, but a one-size-fits-all approach will not work for patients who struggle with audio-visual materials or who do not realize they are instilling the drops incorrectly. One study highlighted how one-on-one interaction...
can allow for remediation of technique.\(^\text{18}\) Patients were recorded self-administering eye drops and then patients viewed the video with their physician, received instruction on how to improve technique, and made a renewed attempt at instilling the eye drops correctly. Before and after video analysis in the study demonstrated positive results with improved accuracy and reduced contamination directly after the intervention.\(^\text{19}\) In the present study, in which our intervention included standardized, yet personalized, in-person coaching by a glaucoma counselor, contamination clearly improved even months from the eye drop instillation coaching session. To our knowledge, the SEE program is the first intervention to demonstrate lasting technique change months after the intervention.

Patient self-efficacy, measured by the EDTSES, is the belief that one is able to instill eye drops appropriately. High self-efficacy is a positive predictor for both glaucoma medication adherence and accurate eye drop technique.\(^\text{17}\) In the present study, mean EDTSES scores increased significantly \((P = 0.007)\) after the SEE intervention. Dreer et al\(^\text{18}\) recently conducted a prospective pilot study of a 4-week personalized counseling intervention based on MI techniques and demonstrated a 15-percentage point increase in electronically monitored adherence and a significant increase in self-efficacy \((P = 0.02)\) among the 11 participants. Our studies are complementary in that MI-based interactions increased self-efficacy for glaucoma medication adherence and self-efficacy for eye drop instillation.

Although an important predictor for success, confidence in eye drop technique does not always translate into quality self-application.\(^\text{39,40}\) For example, in one study, 91% of patients felt confident in their ability to instill eye drops correctly, but 29% still dropped the dropper to the eye or skin.\(^\text{19}\) In the 2016 study by Sayner et al,\(^\text{41}\) patient characteristics and self-efficacy were examined in association with eye drop technique. They found self-efficacy to have no association with eye drop technique. In contrast, we noted that EDTSES scores trended in the correct direction among participants whose eye drop instillation technique improved from before to after the SEE program. For those who contaminated the bottle tip before the SEE program but did not do so afterward, the average EDTSES score increased. Participants who instilled an eye drop outside the eye before the SEE program and improved technique after the program showed an average EDTSES score increase. However, the EDTSES scores did not trend in the correct direction for the assessment of whether eye drops were instilled on the first attempt. For example, among the 5 participants who did not instill an eye drop on first attempt before the SEE program but did so afterward, the EDTSES score decreased on average, whereas the 2 patients whose accuracy decreased showed an average increase in the EDTSES score. We hypothesize that the EDTSES did not trend in the correct direction for this objective assessment of eye drop technique because the EDTSES does not ask directly about placing an eye drop into the eye in only 1 attempt.

The strengths of this study include the rigor of its methods and the assessment of technique before and after intervention. The study also had multiple limitations. As a pilot study, it was exploratory and not powered to detect change in any of the eye drop instillation outcomes. The small sample size precluded us from conducting a full analysis of potential confounders for change in eye drop technique such as visual acuity, visual field loss, presence of comorbidities, or handedness. The small sample size also precluded an evaluation of eye drop instillation success compared with success with medication adherence overall. Video recording also can invoke anxiety in some patients, potentially compromising the eye drop technique. Furthermore, video recording the outcomes of eye drop instillation does not capture fully the differences in physical technique that lead to these differences in outcome. Future work should quantify differences in technique more fully so that the interventions can be tailored better to each individual’s needs. Despite these limitations, this study demonstrated pilot evidence of efficacy in the use of the MI-based SEE counseling program to improve eye drop technique and patient eye drop technique self-efficacy. These results lay the groundwork for a future randomized controlled trial of the efficacy of the SEE program in improving medication adherence and eye drop instillation technique.

Footnotes and Disclosures

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1 Department of Ophthalmology and Visual Sciences, University of Michigan Medical School, Ann Arbor, Michigan.
2 Department of Internal Medicine, University of Michigan Medical School, Ann Arbor, Michigan.
3 Department of Epidemiology, University of Michigan School of Public Health, Ann Arbor, Michigan.
4 Department of Mechanical Engineering, University of Michigan School of Engineering, Ann Arbor, Michigan.
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Author Contributions:
Conception and design: Niziol, Heisler, Musch, Newman-Casey
Analysis and interpretation: Schneider, Hollenhorst, Valicevic, Niziol, Heisler, Musch, Cain, Newman-Casey

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Data collection: Schneider, Valicevic, Niziol, Newman-Casey
Obtained funding: Newman-Casey
Overall responsibility: Schneider, Hollenhorst, Valicevic, Niziol, Heisler, Musch, Cain, Newman-Casey

Abbreviations and Acronyms:
EDITSES = Eye Drop Technique Self-Efficacy Scale; MI = motivational interviewing; SD = standard deviation; SEE = Support; Educate = Empower.

References


**Pictures & Perspectives**

**Descemet’s Tear: *Sine Qua Non* of Acute Hydrops in Primary Congenital Glaucoma**

Parents brought their 1-month-old boy with hazy cornea in the left eye since birth, which suddenly increased for 3 days. There was acute hydrops in his left eye on flashlight examination (Fig A). Examination under anesthesia revealed raised intraocular pressure (30 and 32 mmHg in the right and left eye respectively) and increased corneal diameter (13 mm) in both eyes. The left cornea had a wide Haab’s striae, visible as a large Descemet membrane tear on retro-illumination (Fig B, arrows). Ultrasound biomicroscopy showed the discontinuation in Descemet membrane (Fig C, arrowheads), corresponding to the tear. The patient was diagnosed as primary congenital glaucoma and underwent a combined trabeculotomy with trabeculectomy (Magnified version of Fig A-C is available online at www.ophthalmologyglaucoma.org).

**SAGARIKA SNEHI, DNB**
**GAURAV GUPTA, MS**
**SUSHMITA KAUSHIK, MS**

Advanced Eye Centre, Postgraduate Institute of Medical Education and Research, Chandigarh, India