Beliefs and Attitudes of Ophthalmologists Regarding SLT as First Line Therapy for Glaucoma

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Glaucoma is a sight-threatening condition, which often requires ongoing follow-up and treatment. Glaucoma is a major global health issue, and is a leading cause of irreversible blindness worldwide.1 The prevalence of glaucoma is increasing, causing a significant economic burden.1,2 Because of the rapidly aging population, it is estimated that 3.36 million Americans will be affected by 2020, an ~50% increase from the current 2.2 million Americans with glaucoma.3 Intraocular pressure remains the only clinically modifiable treatment target in the management of glaucoma4–6 and can be reduced through pharmacological treatment, laser therapy, or surgical interventions. These different treatment options are selected by ophthalmologists and depend on the patients’ glaucoma severity, rate of progression, and likely impact of glaucomatous symptoms on their quality-of-life.7–10

Selective laser trabeculoplasty (SLT) is effective in the treatment of primary open angle glaucoma (POAG), ocular hypertension, and pseudoexfoliation glaucoma. It employs Nd:YAG laser at a 532 nm, Q-switched doubled frequency that targets the pigmented tissue on the trabecular meshwork, leading to a controlled local inflammatory response that ultimately increases aqueous outflow through the trabecular pathway.11,12 The selective property of this laser modality enables the use of lower energy and is less likely to induce thermal damage than its predecessor, argon laser trabeculoplasty.12,13 SLT’s efficacy as initial and adjunctive glaucoma therapy has been extensively studied and confirmed14–23 and has led glaucoma management guidelines to consider it as one of the first line treatment modalities.8,24

When comparing it to the most commonly used initial glaucoma treatment, SLT has been found to have similar efficacy to topical intraocular pressure lowering medications.14,15,21–25 Furthermore, SLT has been shown to be effective as a stand-alone treatment as well as a replacement for topical medications, often reducing or removing the need for topical medications.16,17,20,25–29 This reduction of medication dependency decreases the need for daily eye drop adherence and may help lessen the chance of ocular medication side effects.30–34 In addition, SLT has been noted to be a safe technique that is potentially repeatable.

Despite the mounting evidence regarding the effectiveness and safety of SLT as first line therapy, its use in the glaucoma treatment paradigm is not completely well-established.17,37 A gap between glaucoma management recommendations and actual practice is recognized when considering the selection of SLT as first line treatment for glaucoma.35,38 We believed this gap may be partially related to ophthalmologists’ beliefs and attitudes towards laser therapy in ophthalmology and perhaps a misconceived notion that eye drops are a less invasive option to start treatment of an otherwise often asymptomatic condition. We hypothesized that better informed ophthalmologists would

Precis: Targeted educational interventions for physicians may be useful in increasing adoption of selective laser trabeculoplasty (SLT) as first line therapy for the treatment of glaucoma.

Purpose: SLT is a safe and effective first line treatment for glaucoma, however, it is underutilized. To evaluate barriers for the widespread adoption of this procedure, we assessed the beliefs and attitudes of ophthalmologists. We developed an educational intervention directed to physicians to increase the consideration of SLT earlier in the glaucoma treatment paradigm.

Subjects and Methods: In this prospective study, an online survey and educational slide presentation was sent to a group of comprehensive ophthalmologists, ophthalmology residents, and glaucoma specialists. Subjects were asked to respond to questions regarding their beliefs and attitudes towards SLT before and after watching the educational slide presentation.

Results: A total of 53 subjects were enrolled. Before watching the slide presentation, 85% of subjects stated they offer SLT to newly diagnosed patients. While 52% of physicians reported between 0% and 10% of their newly diagnosed patients receive laser therapy, 47% said they would use it as a first line therapy for all or most newly diagnosed glaucoma patients. Most subjects (94%) stated the educational slide presentation convinced them that SLT is appropriate as a first line therapy for treatment of open angle glaucoma.

Conclusions: A better understanding of the barriers for utilizing SLT as a first line therapy provides valuable information to help increase the adoption of this safe and effective procedure. A targeted educational intervention may improve acceptance of SLT as first line therapy for open angle glaucoma.

Key Words: selective laser trabeculoplasty, education, laser therapy

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prefer the use of SLT in place of ocular medications as first line therapy. Therefore, we designed this study to assess the beliefs and attitudes of ophthalmologists regarding SLT as a first line treatment for glaucoma before and after viewing an Educational Intervention. The second aim was to assess possible barriers to the widespread adoption of this procedure in glaucoma management.

**SUBJECTS AND METHODS**

This prospective study was approved by the Wills Eye Hospital Institutional Review Board and adheres to the tenets of the Declaration of Helsinki. Informed consent was obtained from all subjects. Eligible subjects included current faculty (fellowship trained glaucoma specialists and comprehensive ophthalmologists) or ophthalmology residents from the authors’ academic institutions (Wills Eye Hospital and Columbia University Irving Medical Center). Comprehensive ophthalmologists and residents were combined into a general ophthalmology group.

The investigators developed the Educational Intervention about SLT as first line therapy to treat glaucoma using the *American Academy of Ophthalmology (AAO) Practice Pattern Guidelines* and the Glaucoma Research Foundation resources. The evidenced-based Educational Intervention was developed with an aim to improve ophthalmologists’ understanding of SLT. The presentation was focused on 3 main objectives: to define the mechanism of action of SLT, to describe the evidence comparing SLT to medication treatment for glaucoma, and to identify the *AAO Practice Pattern Guidelines for SLT*. Once completed, the principal investigator (L.J.K.) was recorded presenting the slides and the 18-minute Educational Intervention was posted on a password-protected, secure YouTube platform (YouTube LLC, San Bruno, CA). Using a commercial platform (SurveyMonkey, San Mateo, CA) the research team created 2 surveys: an online pre-lecture survey (6 questions) to assess the practice patterns of ophthalmologists in the management of newly diagnosed POAG as well as their general attitudes towards SLT, and post-lecture survey (8 questions) to evaluate newly diagnosed POAG as well as their general attitudes regarding their current practice patterns for newly diagnosed glaucoma patients and their attitudes regarding indications of SLT. At the conclusion of the survey, they were directed to a link to view the Educational Intervention video. Once completed, they were directed to a post-lecture survey on their attitudes regarding SLT as first line therapy.

Responses capturing subjects’ attitudes towards SLT before and after an educational video lecture were summarized using frequencies and percentages for categorical variables, and means, standard deviations, and medians for continuous variables. Responses were compared between glaucoma specialists versus general ophthalmologists and years since residency graduation (below 5, 5 to 20, above 20) using Fisher exact test for categorical variables, the χ² test, and the Kruskal-Wallis test for continuous variables. These tests were also used to compare responses by the percentage of patients who each physician reported to prescribe SLT as a first line treatment (0% to 10%, 11% to 25%, > 25%). All tests were 2-sided at a significance of 0.05. All analyses were done using SAS 9.4.

**RESULTS**

A total of 400 survey invitations were electronically distributed to subjects. A total of 53 physicians participated, including 31 general ophthalmologists (26 comprehensive ophthalmologists and 5 ophthalmology residents) and 22 fellowship trained glaucoma specialists (Table 1). The overall median age since graduation was 10.58 years, with a range of 0.00 to 48.63 years (Table 1).

Before the educational intervention, 84.9% (n = 45) of subjects stated they offer laser therapy to newly diagnosed patients (Supplemental Table 1, Supplemental Digital Content 1, http://links.lww.com/IJG/A431). Glaucoma medications were preferred by 67.9% (n = 36) of subjects as first line therapy, while 28.3% (n = 14) of subjects preferred laser treatment as first line therapy (Supplemental Table 1, Supplemental Digital Content 1, http://links.lww.com/IJG/A431). Approximately half of all subjects (n = 25, 47.2%) considered SLT as first line therapy, while 35.8% (n = 19) considered it as second line therapy (Supplemental Table 1, Supplemental Digital Content 1, http://links.lww.com/IJG/A431). Although there were notable differences in these variables between the subgroups regarding their general attitudes towards use of laser therapy before the educational intervention (eg, glaucoma specialists were more likely to offer SLT as initial therapy than general ophthalmologists, 95% vs. 77%, respectively), these differences were not statistically significant (Supplemental Table 1, Supplemental Digital Content 1, http://links.lww.com/IJG/A431).

Although a slight majority (n = 27, 51.9%) of subjects reported that between 0% and 10% of their patients with newly diagnosed POAG receive SLT, 47.2% said they would use SLT as a first line therapy for all or most newly diagnosed POAG patients (Supplemental Table 1, Supplemental

**TABLE 1. Characteristics of 53 Participants Based on Subspecialty and Years Since Residency Graduation**

| Participants                  | n (%) | Median (Minimum, Maximum) | Mean (SD) | P        |
|-------------------------------|-------|--------------------------|-----------|----------|
| General ophthalmologists*     | 31 (58.5) | 17.62 (0.00, 45.55)     | 17.60 (14.37) | 0.124   |
| Glaucoma specialists          | 22 (41.5) | 4.44 (0.52, 48.63)     | 10.25 (12.23) |         |
| Overall                       | 53     | 10.58 (0.00, 48.63)     | 14.38 (13.84) |         |

*General ophthalmologists = comprehensive ophthalmologists and ophthalmology residents.*
TABLE 2. Significant Differences in Responses by Years Since Residency Graduation

| Prompt                                                                 | <5 y (n = 19) [n (%)] | 5-20 y (n = 15) [n (%)] | > 20 y (n = 14) [n (%)] | P       |
|------------------------------------------------------------------------|----------------------|------------------------|------------------------|---------|
| Where do you see selective laser trabeculoplasty in the glaucoma treatment paradigm? |                      |                        |                        |         |
| Mild to moderate glaucoma                                              | 4 (21.1)             | 0                      | 0                      | 0.03    |
| Depends on patient hesitation                                          | 6 (31.6)             | 0                      | 0                      | 0.003   |

Digital Content 1, http://links.lww.com/IJG/A431). Among those who would use it as first line therapy, good compliance (64.0%, 16/25) and efficacy (60.0%, 15/25) were most commonly cited as reasons for SLT utilization, while patient hesitancy (32.1%, 9/28), patient selection (28.6%, 8/28), lack of evidence (21.4%, 6/28), and availability (21.4%, 6/28) were cited as the most common reasons by those who do not use SLT as first line therapy (Supplemental Table 2, Supplemental Digital Content 1, http://links.lww.com/IJG/A431).

Following the educational intervention, 94.3% of subjects said that the educational program convinced them that SLT is an effective first line therapy, citing safety (56.0%, 28/50), efficacy (54.0%, 27/50), and adherence (52.0%, 26/50) as the main reasons for this belief (Supplemental Tables 1, 2, Supplemental Digital Content 1, http://links.lww.com/IJG/A431). Despite this, 32.1% of subjects were still hesitant to the use of SLT as first line therapy, with patient hesitancy (47.1%, 8/17) and limited experience (35.3%, 6/17) as the main deterents (Supplemental Tables 1, 2, Supplemental Digital Content 1, http://links.lww.com/IJG/A431).

Comparison between specialty groups revealed several significant differences between groups. When compared by specialty groups, glaucoma specialists more frequently considered SLT use in mild to moderate glaucoma[18.2% (4/22) vs. 0.0% (0/31) of general ophthalmologists, P = 0.03] and as adjunctive therapy to drops[50.0% (11/22) vs. 19.4% (6/31) of general ophthalmologists, P = 0.02] (Supplemental Table 3, Supplemental Digital Content 1, http://links.lww.com/IJG/A431). Of the subjects who would not use SLT as first line therapy, glaucoma specialists listed patient hesitation (61.5%, 8/13) more often than general ophthalmologists (6.7%, 1/15; P = 0.004), while general ophthalmologists listed limited availability (40.0%, 6/15) more often than glaucoma specialists (0.0%, 0/13; P = 0.02) (Supplemental Table 3, Supplemental Digital Content 1, http://links.lww.com/IJG/A431). Following the educational intervention, the glaucoma specialists reluctant to recommend SLT as first line therapy cited patient hesitation more often than the general ophthalmologists [77.8% (7/9) vs. 12.5% (1/8), respectively; P = 0.02], and general ophthalmologists cited inexperience with SLT (75.0%, 6/8) more often than glaucoma specialists (0.0%, 0/9; P = 0.002) (Supplemental Table 3, Supplemental Digital Content 1, http://links.lww.com/IJG/A431).

Subjects’ opinions on SLT rarely varied based on the number of years in practice since residency graduation. However, only subjects who graduated residency less than 5 years prior considered SLT in the treatment of mild to moderate glaucoma[21.1% (4/19) vs. 0.0% (0/29) 5 y and above, P = 0.03] and factored patient hesitation in where they see SLT in the glaucoma treatment paradigm [31.6% (6/19) vs. 0.0% (0/29) 5 y and above, P = 0.003] (Table 2).

**DISCUSSION**

SLT is an effective and safe potential first line treatment for glaucoma according to the 2015 AAO Primary Open-Angle Glaucoma Preferred Practice Pattern Guidelines.8 Despite evidence-based recommendations, SLT remains underutilized as a first line therapy for glaucoma. Our study sought to better understand physicians’ attitudes about SLT as first line therapy. The survey confirmed the lag in conversion to SLT as first line treatment among the subjects. Although ophthalmologists appear inclined to use SLT as first line therapy, there seems to be a disparity between their attitudes towards the procedure and their current practice patterns. Although 84.9% of subjects stated that they offer laser treatment to new glaucoma patients, the majority preferred glaucoma medications over laser therapy as first line therapy (67.9% vs. 28.3%, respectively) (Supplemental Table 1, Supplemental Digital Content 1, http://links.lww.com/IJG/A431). Interestingly, almost half of subjects reported that they would use SLT as first line therapy, yet over half of all subjects reported that <10% of their patients with newly diagnosed POAG patients receive SLT, and <10% reported that over 50% of the patients receive SLT (Supplemental Table 1, Supplemental Digital Content 1, http://links.lww.com/IJG/A431). This highlights the discrepancy between physicians’ attitudes and practice patterns. Despite a majority of subjects acknowledging SLT as a viable first line therapy, it is inconsistent with their described practice patterns.

We theorized that the gap can be attributed to negative attitudes towards SLT by ophthalmologists and limited education regarding guidelines and data supporting the use of SLT as first line therapy. This study explored the utility of a focused, evidence-based educational strategy in improving understanding of SLT and promoting the use of SLT as first line therapy among a group of ophthalmologists. Ophthalmologists may have a skewed view regarding SLT, since most utilize it as adjunctive therapy to what is often maximum tolerated medical therapy. In this setting, the success rate is understandably lower then when SLT is utilized as the initial therapeutic step. We found that this educational intervention improved acceptance of SLT as first line therapy, with 94.3% of subjects reporting that the educational program convinced them that SLT is an effective first line therapy (Supplemental Table 1, Supplemental Digital Content 1, http://links.lww.com/IJG/A431). In comparison, only 47.2% of subjects reported considering SLT as first line therapy before intervention (Supplemental Table 1, Supplemental Digital Content 1, http://links.lww.com/IJG/A431). Following the program, those who considered SLT as appropriate as first line therapy, safety (56.0%), efficacy (54.0%), and adherence (52.0%) were most frequently reported as reasons for their decision (Supplemental Table 2, Supplemental Digital Content 1, http://links.lww.com/IJG/A431). Despite the utility of education in increasing acceptance of SLT as first line therapy, there are clearly other factors limiting its utilization.

To help determine the factors limiting the use of SLT as first line treatment, the survey also queried about the barriers to adoption of SLT among subjects. Before the educational intervention, subjects most frequently cited patient hesitation (32.1%), lack of evidence (21.4%), and limited availability (24.1%) as the reasons why they do not use SLT as first line therapy.
specialists, in comparison to the general ophthalmologists, were also more likely to depend on patient hesitation as a deterrent to the use of SLT both before (61.5% vs. 6.7%; $P = 0.004$) and after (77.8% vs. 12.5%; $P = 0.02$) the educational intervention, respectively (Supplemental Table 3, Supplemental Digital Content 1, http://links.lww.com/IJG/A431). This may be related to the difference in patient population among these specialties and the familiarity of evidence-based studies for the use of SLT in this population. Year since graduation was noted to have only a limited impact on attitudes, with those who graduated less than 5 years ago considering SLT in mild to moderate glaucoma (21.1% vs. 0% 5y and above, $P = 0.03$) and that patient hesitation affected where they see SLT in the treatment paradigm (32% vs. 0% 5y and above, $P = 0.003$) (Table 2). These results mirror the differences described above between glaucoma specialists when compared with general ophthalmologist, and may reflect the finding that general ophthalmologists were significantly further out from graduation than the other 2 groups.

We believe that the role of inexperience with SLT as a limiting factor for its use may also be targeted through an educational intervention. In this study, limited experience was cited by general ophthalmologists (75.0%, 6/8) as a reason for their reluctance to use SLT, and not by glaucoma specialists (0.0%, 0/9; $P = 0.002$) (Supplemental Table 3, Supplemental Digital Content 1, http://links.lww.com/IJG/A431). Specifically, all respondents citing inexperience within the general ophthalmology group were comprehensive ophthalmologists, who notably had a median of 22.21 years since graduation. Future initiatives to address the role of inexperience could focus on improving continuing medical education and post-residency training on the use of SLT among general ophthalmologists. Furthermore, availability was cited as deterrent to the use of SLT as first line therapy more often by the general ophthalmology group (6/15, 40.0%) than the glaucoma specialist group (0/13, 0.0%; $P = 0.02$) (Supplemental Table 3, Supplemental Digital Content 1, http://links.lww.com/IJG/A431). Educational programs expanding the understanding and consideration of SLT as first line therapy could lead to further availability of SLT by within general ophthalmology practices, which, in itself, may also serve to reduce the role of inexperience with the procedure.

One significant limitation to this study is the low response rate of 13.5% (53/400 subjects) responded to the questionnaire, despite multiple reminder invitations via email. This limits the applicability of this study and may be a source of bias for the results. Furthermore, the study focused on a relatively small subject pool primarily from a single institution, which may promote similar institutional beliefs and attitudes between different specialty groups, and there were several important differences reported. Although not statistically significant, there was noted to be a difference in the response to the educational intervention between glaucoma specialists and general ophthalmologists. Although both groups had a large majority of respondents state that the educational program convinced them that SLT is an appropriate first line therapy, this was not demonstrated as clearly when asked about their recommendations of SLT as first line therapy.

This study also aimed to evaluate the differences in the beliefs and attitudes between different specialty groups, and there were several important differences reported. Although not statistically significant, there was noted to be a difference in the response to the educational intervention between glaucoma specialists and general ophthalmologists. Although both groups had a large majority of respondents state that the educational program convinced them that SLT is an appropriate first line therapy, this was not demonstrated as clearly when asked about their recommendations of SLT as first line therapy. In the pre-intervention questionnaire, 49.9% (13/31) of general ophthalmologists and 54.5% (12/22) of glaucoma specialists viewed SLT as first line treatment (Supplemental Table 1, Supplemental Digital Content 1, http://links.lww.com/IJG/A431). When asked about the reluctance to use SLT as first line therapy following intervention, 74.2% (23/31) of general ophthalmologists and 59.1% (13/31) glaucoma specialists were reported that they were not reluctant (Supplemental Table 1, Supplemental Digital Content 1, http://links.lww.com/IJG/A431). Although the questions are not identical, they suggest that the educational intervention had large impact on general ophthalmologists and a minimal impact on glaucoma specialists. Although both groups had a perceived benefit from the intervention, the intervention had a more concrete effect among general ophthalmologists. This may be due to the additional training and baseline knowledge about SLT among glaucoma specialists, which may make them more grounded in their perception of SLT and less likely to have an educational program provide new information change their practice patterns. Future studies could focus more on defining this difference, as it may impact the target audience for educational interventions.

There were several statistically significant differences between groups. Glaucoma specialists, in comparison to the general ophthalmologists, more often considered SLT in mild to moderate glaucoma (18.2% vs. 0.0%; $P = 0.03$) and as an adjunctive treatment for glaucoma (50.0% vs. 19.4%; $P = 0.02$), respectively (Supplemental Table 3, Supplemental Digital Content 1, http://links.lww.com/IJG/A431). This may be related to more extensive experience with and availability of SLT among glaucoma specialists. Glaucoma
the educational intervention convincing participants that SLT is an appropriate first line therapy (94.3%) compared with the reluctance to recommend SLT as first line therapy (32.1%), which questions the perceived versus the true effect of the intervention on the participants (Supplemental Table 1, Supplemental Digital Content 1, http://links.lww.com/IJG/A431). Future investigations should be performed using a Knowledge, Attitude, and Practice Model to determine the impact of the educational intervention on the participant’s practice behaviors. However, this study served to determine the efficacy of the described educational intervention in changing physician perception of SLT, decreased reluctance of SLT as first line therapy among general ophthalmologists, and elucidated factors limiting the use of SLT that may be targeted in future interventions.

Although individualization of patient care is essential for safe and effective clinical practice, there is strong evidence for a paradigm shift in the use of SLT as first line therapy. We believe that targeted education for general ophthalmologists can improve understanding and adoption of SLT as first line therapy and promote safe and effective treatment for patients.

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