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ORIGINAL ARTICLE

The incidence of serious complications after selective laser trabeculoplasty

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Abstract

Purpose: To evaluate the incidence of serious complications after selective laser trabeculoplasty (SLT).

Methods: All patients who underwent SLT at the Department of Ophthalmology, Helsinki University Hospital, were eligible for the study from 1 January 2012 to 31 December 2018. Data regarding patients' demographics, procedure details, complications, predisposing factors and clinical outcomes were extracted retrospectively from electronic medical records. The primary outcome measures were serious complications, including corneal oedema, corneal scarring, hyperopic shift, synechia, anterior chamber bleeding and hyphema.

Results: A total of 6081 SLTs (4601 eyes) of 2812 patients were analysed. Twelve patients had bleeding in the anterior chamber angle (incidence 2/1000 SLT laser treatments), and four of them developed hyphema (incidence 0.7/1000 SLT laser treatments). Corneal oedema or Descemet's membrane folds were reported in six treated eyes, resulting in an incidence of 1/1000. One myopic eye had a permanent corneal scarring, thinning and irregular astigmatism with a hyperopic shift (5.3 D with recovery to 1.25 D in three years), resulting in poor visual acuity (from preoperative 0.9 to 0.4 at the last control). The incidence was less than 0.2/1000 for all SLT treatments (95% CI ≤0.1 to 1.0) and 1/648 for SLT laser treatments in high myopia (spherical equivalent ≤−5.00 D).

Conclusions: After SLT, the number of complications was low, with only one permanent vision deterioration after 6081 treatments. These findings may help clinicians reassure patients about SLT safety when offering SLT as a first-line treatment for ocular hypertension or open-angle glaucoma.

KEYWORDS
complication, glaucoma, hyperopic shift, hyphema, selective laser trabeculoplasty

1 | INTRODUCTION

Selective laser trabeculoplasty (SLT) is a safe, effective and standard treatment for glaucoma and ocular hypertension (Garg & Gazzard, 2018). Since SLT was introduced in 2001, it has largely replaced argon laser trabeculoplasty with less scarring and fewer adverse events (Latina & Tumbocon, 2002). In the Laser in Glaucoma and Ocular Hypertension (LiGHT) trial, SLT was shown to be cost-effective as a first-line treatment at three years compared to initial drop therapy and providing better disease control at six years for mild to moderate open-angle glaucoma and ocular hypertension (Gazzard et al., 2019; Gazzard et al., 2023). This has led to a change in clinical practice; in the United Kingdom, SLT is recommended as a first-line treatment, and the European Glaucoma Society recommends SLT as a first-line treatment option (European Glaucoma Society, 2021; National Institute for Health and Care Excellence, 2022). As SLT has moved forward in the treatment algorithm and is also offered to ocular hypertension, its safety requirements have been enhanced.

Common adverse effects after SLT treatment include anterior chamber inflammation, pain or discomfort, redness and moderate IOP elevation. These effects are commonly mild, readily managed and resolved without long-term sequelae (Wong et al., 2015).

Some severe, sight-threatening complications, primarily documented in case reports, have also been noted, though their incidence remains unknown (Shihadeh et al., 2006; Moubayed et al., 2009; Rhee et al., 2009; Regina et al., 2011; Song et al., 2013; Knickelbein et al., 2014; Wood et al., 2018; Loyola Arancibia et al., 2021; Nijs et al., 2024).

In an initial multicentre prospective study establishing the safety and effectiveness of SLT, the incidence of corneal oedema was 0.8% (Latina & Tumbocon, 2002). Since 2009, cases have been reported with corneal complications such as oedema, haze, thinning and irregular astigmatism (Knickelbein et al., 2014; Loyola Arancibia et al., 2021; Moubayed et al., 2009; Nijs et al., 2024; Regina et al., 2011; Song et al., 2013; Wood et al., 2018). Two case reports of hyphema during or after SLT laser treatment have been reported in the literature (Rhee et al., 2009; Shihadeh et al., 2006). Peripheral anterior synechia (PAS) occurs in 0% to 2.86% of eyes after SLT (Wong et al., 2015).

Our study aims to explore the incidence of rare, serious adverse events after SLT and possible predisposing factors.

2 | MATERIALS AND METHODS

All patients who underwent SLT at the Department of Ophthalmology, Helsinki University Hospital, were eligible for the study from 1 January 2012 to 3 December 2018. Patients were identified from hospital records with the procedure code (CHD05), and their electronic medical records (EMR) were retrospectively reviewed. Twenty-two patients were excluded because of miscoding or missing EMR data. Demographic data of patients, SLT procedure details, complications after treatment, predisposing factors to complications and clinical outcome data were extracted from the EMRs. Repeated SLTs and both eyes of patients, if treated, were included in the analysis. The follow-up time varied according to when the patient was included; those included early had longer follow-up times than those included late.

The ethnicity was extracted from the EMR when available. The Finnish population in the included age group at the time of the study was highly homogeneous. Patients with Finnish names were assumed to be of Finnish ethnicity. If the patient was of non-Finnish origin, this was often explicitly noted in the clinical records. Ethnicity is not recorded in a structured format in the EMR used in Helsinki University Hospital.

Patient characteristics collected were sex, ethnicity, glaucoma type, time from diagnosis, laterality of eye treated, age at the time of first SLT, spherical equivalent (SE), glaucoma medications, previous glaucoma laser treatments (laser trabeculoplasty, laser iridotomy and laser iridoplasty), previous glaucoma surgeries, glaucoma surgery type and previous cataract operation. Clinical data, including pre-SLT intraocular pressure (IOP) measured with Goldmann applanation tonometry (GAT) and cup-to-disc ratio, were recorded. From procedure details, we collected the number of laser applications, degrees of treated area, SLT power used, the training status of the clinician performing the SLT, and the type of post-laser anti-inflammatory eye drops prescribed.

The SLT standard delivery protocol was to treat 360° of trabecular meshwork, with 100 nonoverlapping applications of a preset 3 nanoseconds duration and a 400 μm spot size. The laser energy was adjusted to the amount of pigment in the trabecular meshwork, so that bubble formation was seen in approximately 50% of applications. Residents delivered 25% of all SLT treatments. Although the exact number of SLT-delivering ophthalmologists was not collected from the EMR, an estimated 15 consultants and 40 residents were involved in delivering the laser treatments. The post-operative drops prescribed varied: corticosteroids, non-steroidal anti-inflammatory drugs (NSAID), drops pro re nata or no drops. If post-operative eyedrops were not mentioned in the EMR, it was assumed that they were not prescribed. In those cases, patients were advised to contact the hospital if more discomfort than light irritation or photophobia was experienced after the treatment. If the patient did not have any special symptoms, a control visit was scheduled after 1–3 months at the hospital, an outsourced clinic or a private clinic.

Possible predisposing factors for corneal complications collected were the presence of different corneal pathologies, a history of corneal surgeries, previously known herpes simplex virus (HSV) infections, and the presence of lattice corneal amyloidosis (Meretoja syndrome).

The project was approved by the Hospital Region of Helsinki and Uusimaa Institutional Review Board (§4 HUS/126/2021) and followed the guidelines of the Declaration of Helsinki.

Statistical analyses were performed with Microsoft Excel software (Microsoft Corporation, Redmond, WA).

3 | RESULTS

A total of 6081 SLTs in 4601 eyes of 2812 patients, 65% female and 98% white, were analysed (Table 1). The yearly number of new SLT-treated eyes tripled during 2014–2018 from 368 to 1276 treatments, and the proportion of primary treatments increased from 3.5% to 17.2%. The mean number of IOP-lowering drops during the first, second, third and fourth SLT was 2.1 ± 1.3, 2.6 ± 1.2, 2.7 ± 1.2 and 2.7 ± 0.9, respectively.

The most common diagnoses were primary open-angle (45%), normal-tension (22%) and exfoliation glaucoma (20%). Refractive error data were available for 3442 eyes (75%), including 471 (14%) eyes with high myopia (SE −5.00 D or worse, Table 1). One-third of the eyes (31%) were pseudophakic before the first SLT, and some had previous other laser treatments or glaucoma surgery.

The treatment area was mentioned for 5976 (98%) SLT treatments. SLT was delivered for 360° in 5629 treatments (94%), for 180° in 193 treatments (3%) and for 90° in 11 treatments (0.2%). Other treatment areas were used 143 times (2%), mostly due to a narrow angle or some other anatomic features, such as a prominent orbital rim. Data regarding post-operative eyedrops were available for

TABLE 1 Baseline demographics before the first selective laser trabeculoplasty.

Demographics	
Patients, *n* (%)	2812
Women	1832 (65)
Age	
Median (range), years	71 (20–97)
Ethnicity, *n* (%)	
White	2759 (98)
Black	19 (0.7)
Chinese	6 (0.2)
Asian[a]	13 (0.5)
Not known	15 (0.5)
Eyes, *n* (%)	4601
Left	2331 (51)
Right	2270 (49)
Spherical equivalent, *n* (%)	
Data available	3442 (75)
SE ≤−5 D	471 (14)
Primary SLT, *n* (%)	490 (11)
Time from diagnoses	
Data available, *n* (%)	3767 (82)
Median (range), years	3.9 (0–52)
Mean±SD, years	6.3±7
Number of medications	
Mean±SD, (range)	2.3±1.3 (0–5)
No medication, *n* (%)	699 (15)
PGA, *n* (%)	3641 (79)
Beta-blocker, *n* (%)	2630 (57)
CAI, *n* (%)	2407 (52)
Alpha-agonist, *n* (%)	826 (18)
Pilocarpine, *n* (%)	105 (2)
Per oral CAI, *n* (%)	104 (2)
Rock-inhibitor, *n* (%)	1 (0.02)
Diagnosis, *n* (%)	
POAG	2081 (45)
Normal-tension glaucoma	1027 (22)
Exfoliation glaucoma	938 (20)
Ocular hypertension	282 (6)
Pigmentary glaucoma	115 (2)
Juvenile glaucoma	85 (2)
Angle-closure glaucoma	21 (0.5)
Uveitic glaucoma	11 (0.2)
Other	41 (0.9)
Pseudophakia, *n* (%)	1410 (31)
Glaucoma laser treatments, *n* (%)	
Laser peripheral iridotomy	181 (4)
Argon laser trabeculoplasty	167 (4)
Iridoplasty	30 (0.7)
Glaucoma surgeries, *n* (%)	80 (2)
Deep sclerectomy	14 (0.3)
Trabeculectomy	50 (1)
Transscleral CPC	9 (0.2)
Other	7 (0.2)
Refractive surgeries, *n* (%)	47 (1)
LASIK	33 (0.7)
PRK	10 (0.2)
Radial keratectomy	4 (0.09)
Keratoconus / post-LASIK ectasia, *n* (%)	8 (0.2)
Penetrating keratoplasty, *n* (%)	5 (0.1)
Lattice corneal amyloidosis, *n* (%)	6 (0.1)
HSV keratitis or -conjunctivitis, *n* (%)	11 (0.2)
Vein occlusion, *n* (%)	
BRVO	33 (0.7)
CRVO	38 (0.8)
Diabetes, *n* (%)	632 (14)
Total number of SLT treatments	6081

Abbreviations: BRVO, branch retinal vein occlusion; CAI, carbonic anhydrase inhibitor; CPC, cyclophotocoagulation; CRVO, central vein occlusion; D, dioptre; HSV, herpes simplex virus; LASIK, laser-assisted in situ keratomileusis; PGA, prostaglandin analogue; POAG, primary open-angle glaucoma; PRK, photorefractive keratectomy; SE, spherical equivalent; SLT, selective laser trabeculoplasty.

[a]Including: Southeast Asian 3, South Asian 6, Middle Eastern/West Asian 4.

5962 (98%) of the SLT treatments. An SLT without postoperative prescription was delivered 3462 times (58%). Corticosteroid eye drops were prescribed after 1107 (19%), NSAID after 239 (4%) for preventive purposes, and pro re nata corticosteroids after 310 (5%), and pro re nata NSAID after 827 (14%) SLT treatments. Combined NSAID and corticosteroids or combined with chloramphenicol were prescribed after 17 (0.3%) treatments.

3.1 | Hyphema

During or after SLT, bleeding into the anterior chamber (AC) from the TM or Schlemm's canal or a small vessel in the angle was noted in twelve eyes of twelve patients (0.2% of all SLTs, Table 2). In nine eyes, it was the first SLT of the eye, but in two, it was the second, and in one, the third SLT. In three cases, bleeding was not noted during the SLT, but patients returned to the hospital with blurred vision and hyphema (Table 3). Four patients had hyphemas (0.07% of all SLTs, Table 2). Two patients with hyphema had IOP spikes of 30 and 31 mmHg, measured one to two days after SLT, but no surgical interventions were needed (Table 3). A short-term decrease in IOP by 20% or more after SLT, with the same number of medications, was achieved despite bleeding in 6/11 patients (55%) and 1/4 patients with hyphema (25%). One patient with hyphema developed multiple broad synechiae, but he also had a few synechiae in the untreated fellow eye.

3.2 | Corneal adverse effects

Corneal oedema or Descemet's membrane folds were noted in six eyes of five patients after SLT treatment

TABLE 2 Adverse events after selective laser trabeculoplasty.

	Total *n* (%)	1st SLT *n* (%)	2nd SLT *n* (%)	3rd SLT *n* (%)	4th SLT *n* (%)
Number of SLT treatments	6081	4601	1295	173	12
Bleeding from AC angle	12 (0.2)	9 (0.2)	2 (0.15)	1 (0.6)	–
Including hyphema	4 (0.07)	4 (0.09)	–	–	–
Anterior chamber inflammation	65 (1)	47 (1)	16 (1)	2 (1)	–
Corneal oedema or DM folds	6 (0.1)	5 (0.11)	1 (0.08)	–	–
Including hyperopic shift	1 (0.02)	–	1 (0.08)	–	–

Abbreviations: AC, anterior chamber; DM, Descemet's membrane; SLT, selective laser trabeculoplasty.

TABLE 3 Bleeding from anterior chamber angle after selective laser trabeculoplasty treatment.

Patient	Surgeon's training status	Bleeding from TM or SC	Bleeding from a vessel	Hyphema (mm)	Anticoagulation or antiplatelet therapy	Related adverse events
1	Consultant	Yes	–	–	Rivaroxaban	–
2	Consultant	–	–	0.5	Aspirin	IOP 31 mmHg, mild transient VA deterioration
3	Consultant	Yes	–	–	Apixaban	–
4	Consultant	–	Yes	–	–	–
5	Resident	–	–	1.6	Warfarin	IOP 30 mmHg, mild transient VA deterioration
6	Consultant	Yes	–	–	–	–
7	Consultant	Yes	–	–	–	–
8	Consultant	Yes	–	Small	Aspirin	Synechiae, mild transient VA deterioration
9	Resident	–	Yes	1.3	Aspirin, ibuprofen	Vitreous haemorrhage, transient VA deterioration to hand motion
10	Resident	Yes	–	–	–	–
11	Resident	Yes	–	–	–	–
12	Resident	Yes	–	–	Apixaban	–

Abbreviations: IOP, intraocular pressure; SC, Schlemm's canal; TM, trabecular meshwork; VA, visual acuity.

(0.1% of all SLTs, Table 2). Four patients had high myopia, with a SE from −5.25 D to −20 D (Table 4). Four patients recovered without sequelae. One myopic (SE −5.25) patient developed a hyperopic shift, corneal thinning and scarring with irregular astigmatism. She recovered from the first SLT (360 degrees, 0.3 mJ), but after a repeat SLT 2.5 years later (360 degrees, 0.9–1.0 mJ), she developed anterior stromal haze, Descemet's folds, mild epithelial swelling and corneal erosion. Seven weeks later, the cornea was thinner centrally, with an anterior stromal scar and highly irregular astigmatism (Figure S1). The hyperopic shift improved to 1.25 D, but her vision did not recover to the preoperative level, but remained 0.4.

One Chinese patient with high myopia (SE −9.5 D and −8.5 D) and pigmentary glaucoma developed bilateral broad synechiae after SLT.

SLT was performed without complications for patients with corneal conditions, such as previous refractive surgery, keratoconus or a history of post-Laser-assisted in situ keratomileusis (LASIK) ectasia, penetrating keratoplasty, lattice corneal amyloidosis (Meretoja syndrome) or HSV keratitis or conjunctivitis (Table 1).

3.3 | Cystic macular oedema

A new branch retinal vein occlusion (BRVO) occurred 2–3 months after SLT in two patients, and a central retinal vein occlusion (CRVO) in one patient. One patient with a history of uncomplicated cataract surgery had cystic macular oedema (CME) two months after SLT. A young patient with pigmentary glaucoma and CRVO had increased CME and decreased vision six days after SLT. One patient had a history of complicated cataract surgery, AC intraocular lens and pars plana vitrectomy for epiretinal membrane with postoperative CME. She had a recurring CME at the time of SLT, and by two weeks post-procedure, the CME had worsened.

TABLE 4 Demographics and selective laser trabeculoplasty procedure details of patients with corneal adverse events.

Patient									
Demographics	**1**	**1**	**2**	**3**	**4**	**5**	**6**	**6**	**7**
Age (years)	71	71	82	68	56	70	65	65	72
Gender	Female	Female	Male	Female	Female	Female	Female	Female	Male
Eye laterality	Right	Left	Right	Right	Right	Left	Right	Left	Left
Glaucoma type	POAG	POAG	EXG	EXG	PG	POAG	PG	PG	NTG
Spherical equivalent (D)	−20	−17	−2.375	1.25	−6.375	−5.25	−0.625	−0.25	−1.25
IOP-lowering eyedrops	PGA, beta-blocker, CAI, alpha-agonist	PGA, beta-blocker, CAI	CAI, alpha-agonist	PGA, beta-blocker, CAI, alpha-agonist	PGA	PGA, beta-blocker	PGA, CAI	PGA, CAI	PGA
Consecutive SLT	1st	1st	1st	1st	1st	2nd	1st	1st	1st
Laser applications (*n*)	105	99	100	Unknown	100	92	100	100	100
Laser energy (mJ)	0.6	0.6	0.3	0.8	0.5	1.0	0.5	0.5	0.35
Surgeon's training status	Resident	Resident	Consultant	Consultant	Consultant	Consultant	Consultant	Consultant	Consultant
AC angle pigmentation	Light	Light	Light	Light	Heavy	Light	Heavy	Heavy	Unknown
Pre-SLT IOP (mmHg)	23	19	16	18	34	26	23	20	20
Corneal erosion	–	–	–	–	–	Yes	Yes	Yes	Yes
Corneal oedema	–	–	–	Yes	Yes	Yes	Yes	Yes	–
Descemet's membrane folds	Yes	Yes	Yes	Yes	Yes	Yes	–	–	–
Hyperopic shift	–	–	–	–	–	Yes	–	–	–
Permanent VA impairment	–	–	–	–	-	Yes	–	–	–

Abbreviations: AC, anterior chamber; CAI, carbonic anhydrase inhibitor; EXG, exfoliation glaucoma; IOP, intraocular pressure; NTG, normal-tension glaucoma; PG, pigmentary glaucoma; PGA, prostaglandin analogue; POAG, primary open-angle glaucoma; SLT, selective laser trabeculoplasty; VA, visual acuity.

3.4 | Anterior chamber inflammation

Mild anterior chamber inflammation was treated in sixty-five eyes of forty-seven patients (Table 2). Nine out of forty-seven patients had received preventive NSAID or corticosteroid treatment, and two pro re nata NSAID after SLT treatment. The incidence of anterior chamber inflammation was 1/100 SLT treatments, 1.4/100 for all eyes and 1.7/100 treated patients.

3.5 | Overall complication incidences

The incidence of hyphema was 0.7/1000 laser treatments (Table 2). Corneal oedema or Descemet's membrane folds occurred in six eyes, resulting in an incidence of 1/1000 laser treatments. One myopic eye developed corneal scarring and thinning, a hyperopic shift and irregular astigmatism, causing only permanent vision deterioration after 6081 SLT treatments. The incidence of permanent visual acuity impairment was less than 1/4601 for all eyes, 0.2/1000 SLTs (95% CI ≤0.1 to 1.0) and 2/1000 eyes with known high myopia (SE ≤−5.00 D).

4 | DISCUSSION

Serious complications after SLT occur with a very low incidence. Hyphema occurred in 0.7/1000 laser treatments, and corneal oedema or Descemet's membrane folds in 1/1000 laser treatments.

The SLT mode of action has been studied in vivo and in vitro, implicating that it might impact extracellular matrix remodelling in the trabecular meshwork (Chen & Zeng, 2024). SLT induces cytokine synthesis and secretion from TM cells. Monocytes are recruited, increasing aqueous humour outflow by further secreting cytokines or directly phagocytizing fragments in the TM. Schlemm's canal (SC) cell conductivity is increased. SLT has been reported to cause transient endothelial cell count and central corneal thickness reductions, both of which return to baseline after 1 month (Lee et al., 2014).

The first two initial studies reported a 0.8% incidence of corneal oedema, establishing the safety and effectiveness of SLT in 1999 and 2001 (Latina & Tumbocon, 2002). Corneal oedema was reported in 1 out of 121 patients. This is comparable to our study with over 6000 SLT treatments, where the incidence of corneal oedema or Descemet's folds was slightly less than 0.1%. Since 2009, there have been case reports of patients with corneal oedema, haze and thinning. The patients were highly myopic (SE between −5.00 and −20) before treatment and developed a hyperopic shift in their refraction; this implicates myopia to be a contributing factor to hyperopic shift and corneal scarring (Knickelbein et al., 2014; Loyola Arancibia et al., 2021; Nijs et al., 2024; Regina et al., 2011; Song et al., 2013; Wood et al., 2018). After 6081 SLT treatments, we observed one hyperopic shift with irregular astigmatism and corneal thinning. The complication occurred in an eye with myopia of SE −5.25 D. The eye recovered from the first SLT with low energy (0.3 mJ). Still, the second SLT with higher energy (1.0 mJ) caused permanent alterations in the cornea, suggesting that higher energy combined with high myopia could contribute to corneal damage. In clinical practice, the laser energy settings are typically titrated by angle pigmentation and bubble formation. Recently, Dahlgren et al. (2024) showed that higher energy, that is, cavitation bubbles in 50% to 75% of the laser spots, is more efficient than lower energy, that is, energy level just below the cavitation bubble threshold. In light of our study, avoiding high SLT energy levels with frequent bubble formation may be advisable in patients with high myopia.

The prevalence of high myopia is estimated to increase significantly globally. It is predicted that by the year 2050, there will be 938 million people with high myopia, representing 9.8% of the world population (Holden et al., 2016). This implies an increase in the number of glaucoma patients and the number of SLT treatments for eyes with high myopia. This might lead to an increase in the number of rare SLT complications.

Herpes simplex virus activation has been previously proposed as a possible mechanism for the corneal adverse effects of SLT (Liu et al., 2017; Moubayed et al., 2009; Regina et al., 2011). This is not supported by our study, where there were ten SLT-treated eyes with a history of HSV keratitis and one with HSV conjunctivitis. None of the patients experienced either HSV reactivation or corneal side effects. In addition, none of the patients with corneal adverse effects from SLT had any known history of HSV-related infections in the eye.

There is one case report of diffuse lamellar keratitis after SLT in a patient with myopic LASIK (Holz & Pirouzian, 2010). Our study included 33 eyes with previous LASIK with no complications after SLT. Severe iritis with choroidal effusion is also reported in one case report (Kim & Singh, 2008). In our study, patients were advised to use NSAID or corticosteroid drops routinely after treatment or pro re nata. A minority of the patients with symptoms visited the hospital shortly after SLT. Sixty-five mild anterior chamber inflammations were diagnosed after 6081 SLTs, but no severe anterior chamber reaction or any choroidal effusion was recorded.

Two case reports of hyphema noticed during or after SLT have been reported in the literature (Rhee et al., 2009; Shihadeh et al., 2006). In the first report, a hyphema was noted 3 days after SLT. Intermittent use of oral NSAID and chronic topical NSAID were discussed to be a contributing risk factors (Rhee et al., 2009). In the second case, the patient received SLT in both eyes. Hyphema occurred during SLT in the left eye and resolved spontaneously (Shihadeh et al., 2006). We report four more cases of hyphema. Four cases after 6081 SLT treatments have an incidence of 0.07%. After SLT, bleeding from the AC angle after SLT treatment was rare (0.2% of all treatments), but in the case of bleeding, the risk of hyphema was marked (4 out of 12 cases). All four patients with hyphema were on antiplatelet or anticoagulation treatment. More interestingly, if bleeding occurred while on antiplatelet treatment (aspirin), it led to hyphema in all four cases. Three patients with bleeding treated with direct Xa inhibitors did not develop hyphema. This might suggest that if bleeding from the AC angle or TM occurs,

it tends to be more severe in patients on antiplatelet therapy compared to those on direct factor Xa inhibitors or no anticoagulation therapy. However, the number of patients with hyphema was small.

Cystoid macular oedema after SLT has been reported in case reports: two cases with diabetes, one with complicated cataract surgery, one with previous pars plana vitrectomy for epiretinal membrane and one with BRVO (Ha et al., 2014; Richardson-May et al., 2024; Wechsler & Wechsler, 2010; Wu et al., 2012). In our study, three new vein occlusions occurred two to three months after SLT and were most probably unrelated to SLT treatment. In two patients, the CME worsened shortly after SLT was noted, but it is difficult to interpret the role of SLT treatment compared to the effect of CME treatment. We included 71 eyes with previous BRVO or CRVO. Of all SLT-treated eyes, 632 (14%) were known to have diabetes. Based on this retrospective analysis, the role of SLT in CME is incomprehensive and needs further evaluation.

The strength of the study is the large sample size, with no exclusion criteria. Due to the rarity of the complications, we chose to include all SLT-treated eyes, including repeated procedures, and both eyes of the patients with SLT done in both. This may raise some statistical concerns, as the contralateral eyes are not independent. However, the rarity of the complications, including only one eye and one procedure, would have limited the number of observed complications. Due to the scarcity of complications, the statistical modelling of correlation between eyes is challenging.

The EMRs were all reviewed by a glaucoma specialist, and the data were collected manually. Limitations of the study include that the data in the EMR is unstandardized. The recognition of shortly passing complications was limited to the patients who actively searched for additional control visits, and hence, the study might underestimate the incidences. Access to private sector or outsourced clinics' EMR was limited, and patients with complications might have contacted the private doctor, leading to underestimation of the incidences. Although it is unlikely, patients were advised to contact the operating unit.

A transient IOP rise after SLT has been reported to be 0–62%, and if prophylactic empirical treatment is used, 0–28.8% (Wong et al., 2015). Also, high IOP spikes have been reported in case reports in heavy pigment angles (Harasymowycz et al., 2005). In this study, IOP was not regularly measured within hours to days after SLT, and a control visit was often arranged in outsourced clinics or the private sector. In this retrospective study, we were not able to define the incidence of IOP spikes or the visual impairment caused by glaucoma progression after SLT. Most of the patient population was white, and thus, our results may not be generalized to non-white patients.

In conclusion, the incidence of serious complications after SLT is very low. Only one complication led to permanently poor visual acuity after 6081 treatments. Clinicians should avoid targeting blood vessels in the AC angle and might consider using lower energy settings when treating high myopic patients. SLT is a very safe but not completely risk-free treatment for open-angle glaucoma.

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CONFLICT OF INTEREST STATEMENT

Eeva S. Ojanen has received lecture fees from Santen Finland and congress expenses from AbbVie Finland. Joni A. Turunen has received lecture fees from Thea Finland and Santen Finland. He has served on the advisory board of Novartis Finland and as a consultant for Maculaser Oy. Mika Harju has received lecture fees from Thea Finland and Santen Finland. He has served on the advisory board of Allergan. All are unrelated to this work.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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