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OUTCOME OF LASER MANAGEMENT IN GLAUCOMA DISEASE

Salaah A. Majeed Hendi[1], ELAF FALIH ABBAS and Saja Kamil Saleh[3]
[1]Al_Falluja teaching hospital, Alanbar, Iraq
[2]Al_Sader teaching hospital, Basrah, Iraq
[3]Al_forat Al_Awsat teaching hospital, Najaf, Iraq
*Corresponding e.mail amin_anoon3@yahoo.com

ABSTRACT

The study aimed to evaluate the efficacy and predictive factors of success after selective laser trabeculoplasty (SLT) for treating various types of open-angle glaucoma in iraq.

Design: The study employed a retrospective cohort design.

Materials and Methods: The study retrospectively recruited subjects diagnosed with open-angle glaucoma receiving first time selective laser trabeculoplasty. Primary open-angle glaucoma (POAG), ocular hypertension (OHT) and other types of open-angle glaucoma were included. Reduced intraocular pressure (IOP) of 20% or decreased number of antiglaucoma drugs usage after SLT was defined as success. Various parameters were analyzed for association with SLT success.

Results: 192 eyes were recruited in the study. Mean pre- and postSLT IOP were 19.31 ±3.59 and 15.04±3.13 mmHg, respectively. IOP decreased significantly in all follow-up visits ($p<0.001$). Overall, 59.4% met the treatment endpoint. More than 10% postSLT IOP elevation at 1 hour was the only covariate positively associated with SLT success in both univariate (odds ratio (OR) = 1.042, $p = 0.037$) and multivariate analyses (OR = 1.040, $p = 0.046$). Underlying hypertension and preSLT IOP were negatively associated with SLT success in both univariate (OR = 0.970, $p = 0.026$, OR = 0.955, $p < 0.001$) and multivariate analysis (OR = 0.970, $p = 0.026$, OR = 0.991, $p < 0.001$).

Conclusion: IOP significantly decreased as well as the number of antiglaucoma drugs needed after SLT. More than 10% postSLT IOP elevation at 1 hour was a positive predictor whereas systemic hypertension and preSLT IOP were negative predictors of SLT success.

***Keywords*:** selective laser trabeculoplasty, outcome, success, factors.

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INTRODUCTION

Glaucoma is one of the primary causes of permanent vision loss in the globe, and the use of lasers in the treatment of the disease is becoming increasingly common.
This blindness disease's paradigm is continually expanding. Lasers can be used to treat glaucoma in a variety of ways, including: intraocular pressure (IOP) is reduced by targeting the trabecular meshwork performing a laser iridotomy on the peripheral eyes Ablation of cilia and decrease in aqueous humor production can be achieved by using laser photocoagulation (LPI) and other methods. improving surgical treatments like

trabeculectomy, for example.There are several new approaches and breakthroughs in laser therapy for the treatment of glaucoma that are covered in this article.

LASER TRABECULOPLASTY

Argon Laser Trabeculoplasty (ALT)

Wise and Witter initially described ALT in 1979. A thermal effect was hypothesized to be the result of the argon laser. regions near to laser applications are stretched and broadening as a result of the laser's effects on the trabecular meshwork This enables for For a reduction in IOP, a rise in trabecular meshwork outflow into Schlemm's canal [1].In addition to phagocytosis, ALT has been shown to have other mechanisms of action [2].enhanced cell proliferation and higher metallo-proteinase activity have resulted in lower resistance to outflow.trabecular meshwork levels [3, 4].Pseudoexfoliation glaucoma and primary open angle glaucoma are the most common reasons for ALT surgery.As a first-line treatment for pigmentary glaucoma (PG) and pigmentary xanthoma (PXF).75-85% of patients who get ALT see a reduction in IOP of 20-30%. However, the procedure's effectiveness Diminishes by half in five years, and by three-quarters in ten.After a successful initial ALT, repeat ALT success percentages are not encouraging. The success rates of ALT repetitions range from There has been a decline in success rate from 21% to 70% over time [5]. Primary ALT regulated IOP, according to a study by Agarwal et al.When ALT was applied secondarily, only 10% of eyes showed signs of deterioration after five years [8].One of the most prevalent side effects of ALT is an increase in intraocular pressure (IOP) soon following treatment.Thirty-five to fifty percent [9] of the patients Peripheral anterior synechia can occur in up to 33% of people. Other Occasionally, hyphema or corneal abrasions may occur as a result of prolonged inflammation [10].

LASER IRIDOPLASTY (LI)

LI uses photocoagulative ablation of the iris's peripheral rim. " The iris' stroma changes color when heat is transferred to it.the angular recess widens as it compresses (Fig. 4). PIS and angle closure were two of the conditions that warranted LI.When the iridocorneal angle is narrow and difficult to see, nanophthalmos and laser trabeculoplasty preparation are necessary.Radiation from argon or diode lasers is used on the iris' periphery after the miotic has been implanted to expand the pupil.angle.

EXCIMER LASER TRABECULOTOMY (ELT)

ELT technology is based on the idea that microperforations in the trabecular meshwork might increase aqueous outflow.Schlemm's channel's mesh and inner wall. Xenon chloride excimer laser absorption is used in this device.An interstitial with an 80-ns duration and a 308-nm wavelength. Glaucoma patients prefer ELT because it is considered to be relatively painless and quick to recover from Trabecular meshwork surgery with low thermal damage [11]. Mean IOP drop was noted by Babighian et al.More than 90 percent of patients with clinically minor problems saw an IOP drop of 20 percent or more.in a moreIt was this group's job to compare ELT with SLT in a more current work (180 degree treatment). 100% of the time whenWith no additional glaucoma medication, laser, or surgical therapy, IOP was reduced by about 20%, and the ELT reduced it by 53.3% in that time.both groups, although qualifying success rates (where IOP was reduced by 20 percent with or without the use of an IOP-lowering agent) were 40 percent for the SLT group.33.3 percent of the ELT group and 26.6 percent of the SLT group had further glaucoma medication, laser, or surgical therapy,

respectively. Mean In the ELT group, IOP reduced by 29.6 percent, and in the SLT group, it decreased by 21 percent.

TRANSSCLERAL CYCLOPHOTOCOAGULATION (TSCPC)

A technique called transsphenoidal ciliary pressure reduction (TSCPC) was developed by Vucicevic et al. to reduce intracranial pressure (IOP).as a result, the amount of aqueous humor produced will be reduced. Direct use of laser energy is employed by TSCPC.conjunctiva and sclera with no ciliary body visible. This method can be used with either a syringe or a needle.ND:YAG or a diode laser, and the tissue is primarily coagulated as a result of the laser's action. Reactive Irritis, a minor issue, was one of the minor side effects of temporary discomfort and conjunctival edema. Permanent hypotony and anterior segment hemorrhages are all symptoms of Phthisis bulbi.In the literature, significant problems have been documented [12]. One of the rarest and most deadly complications is sympathetic ophthalmia.After TSCPC, the incidence was predicted to be 0.07 percent [8]. The reported success rates are wildly inconsistent and largely However, the rate of difficulties increases as the degree of energy used increases. The TSCPC reportPre-treatment medication use was reduced by up to 50% in patients with an IOP reduction of 35-45% [7]. The treatment's efficacy is dependent on the patient's age, prior surgical treatments, and the type of glaucoma they have. Improved outcomes can be obtained by Treatments for open-angle glaucoma and other kinds of glaucoma are sometimes required multiple times.

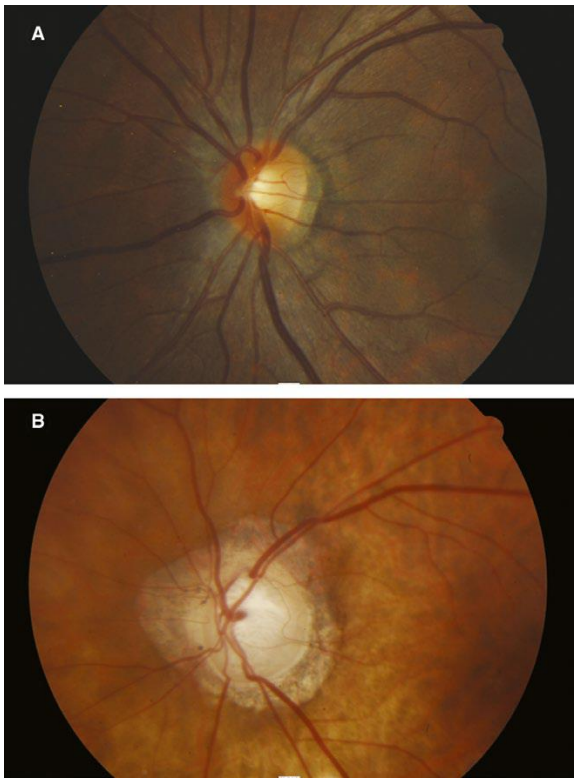
ENDOSCOPIC CYCLOPHOTOCOAGULATION (ECP)

ECP uses a fiber optic endoscope to deliver diode laser energy to the ciliary processes. The endoscope is a small, flexible instrument.Through the pars plana or limbus, under direct observation utilizing a video monitor.In comparison to the trans-scleral approach, ECP may reduce the risk of overtreatment and phthisis bulbi. In IOP dropped from 24.0 mmHg on average to 15.4 mmHg in a group of patients who had previously failed therapy with tube shunts, and After a year, the medication number for glaucoma went from 3.2 to 1.5. Cataract surgery can be performed in conjunction with ECP.lower-risk glaucoma patients Studying ECP with phacoemulsification resulted in a considerable increase in intraocular pressure A reduction in all time points after 35 months. There was a decrease in the average IOP from 23.1 mmHg to 12.3 mmHg afterThis is the last time I see you. Immediate increases in intracranial pressure, anterior chamber inflammation, and cystoid macular are all possible side effects of ECP.inflammation, hypotony, necrosis, choroidal hemorrhages, retinal edema, and fibrin deposition in the anterior chamber are all symptoms of phthisis in the anterior chamber.[7].

LASER ASSISTED DEEP SCLERECTOMY

An alternative to invasive trabeculectomies is a nonpenetrating deep sclerectomy performed by hand.Although this operation has a low risk of postoperative complications, it is challenging to perform. In an effort to make things easier, A variety of lasers, including CO2, excimer, and erbium, have been suggested for the manual deep sclerectomy procedure: YAGlasers are a type of light source. First, a superficial flap is manually created, after which many laser treatments are performed. This Ablation of deep scleral tissue continues until water permeation is accomplished.Using an erbium:YAG laser, Klink et al. reported an 83.3 percent success rate (IOP or =21 mmHg+IOP decrease > After three months, the success rate was 20%, and after 12 months and 50.5 months, it was 50%. The total number of people.At 50.5 months postoperatively, glaucoma medicines were lowered from 3.07+/-0.92 preoperatively to

1.14+/-1.41.Using a CO2 laser to assist in deep sclerotherapy was found to be safe and effective [7]. Prior to surgery, When IOP was 27.3 mmHg at the beginning, it reduced to 15.0 mmHg at six months and 16.6 mmHg at a year's time, on average.With regard to overall success, the figure was 45.5%, while qualified success was 90.9% [8]. An excimer laser is a allows for thermal damage-free dissection of the sub-laminar layer for more regular and smoother results.



1 Figure showing a normal left optic disc (A)* and a left optic disc with end-stage glaucoma (B)

METHODS AND SUBSTANCES

A retrospective cohort design was used in the study. The total number of patients who received a diagnosis of open-angle glaucoma and underwent a first-time SLT procedure at the Ophthalmology Clinic hospital between January 2018 and December 2020 was 192. Pseudoexfoliation glaucoma (PXG), juvenile open-angle glaucoma (JOAG), and other secondary open-angle glaucoma, such as steroid-induced glaucoma or angle recession, that was not contraindicated for SLT were also included. Inclusion criteria included having peripheral anterior synechia prior to SLT and a follow-up of less than six months, new or modified medication regimes that could affect IOP, such as steroid use, or undergoing ocular surgery other than glaucoma intervention during the first six months of the study, or missing study parameters.

SLT was conducted by one of four glaucoma specialists at the clinic on all participants. Pilocarpine and Tetracaine hydrochloride were applied 30 minutes and 5 minutes before the laser treatment, respectively, for all patients. With a frequency-doubling Q-switched Nd YAG laser emitting at 532nm with a pulse duration of 3 nanoseconds and a spot size of 400 microns concentrating on trabecular meshwork, SLT was conducted. The initial amount of energy was 0.7mJ, which was titrated until an air bubble was seen..

The surgeon's preference influenced the laser area's expansion and the postoperative prescription. One hour after SLT, we measured IOP and examined the eyes under a slit lamp in all of the patients. Subjects were instructed to keep taking their glaucoma medication unless they experienced any negative side effects. After SLT treatment, there were follow-up visits every week (optional), every three months, every six months, every year, and every 24 months.

The following data points were gathered from the treatment date: Pre-SLT IOP, best corrected visual acuity (BCVA), pre-SLT cup-to-disc ratio (C:D), visual field mean deviation (VFMD), indication for SLT treatment, gonioscopic grading, lens status, cup-to-disc ratio (C:D), visual field mean deviation (VFMD), total laser power, and pre-SLT type of antiglaucoma drug are all taken into consideration. Other factors include age, gender, underlying systemic and These measurements were taken during follow-up visits: Complications, the amount and type of antiglaucoma medicines prescribed, the IOP (as measured by gonioscopy), the lens state, the C:D ratio, and any extra intervention or treatment required

Opthalmology (eye surgery)

Analytical Methods

When IOP drops by 20% or antiglaucoma medications are used at a lower rate following SLT, it is considered a successful treatment. A paired t-test was used to compare the differences between the study's participants. Mean SD (range) was used for continuous data, whereas the number of categories was used for categorical variables (percent). Univariate analysis was used to identify 20 factors that were linked with SLT success. After that, we performed a multivariate analysis by eliminating any factors that were highly correlated with each other. Statistical significance was determined as a p-value less than or equal to 0.05 for all relationships given as odds ratios (OR) and a p-value of <0.05 was defined as statistically significant

RESULTS

Table 1 Demographic Data

65.81±12.91 (33–85)	Age (year)
104 (54.2)	male
88 (45.8)	female
192	Total

Diabetes mellitus	48 (25.0)
Hypertension	90 (46.9)
Follow-up time (month)	18.09±6.33 (6–24)
Best corrected visual acuity (logMAR)	0.28±0.3 (0.0–1.6)
IOP pre-SLT (mmHg)	19.31±3.59 (10–30)
Visual field mean deviation (dB)	−9.35±8.14 (−29.33–1.58)
Diagnosis	
OHT	16 (8.3)
POAG	146 (76.0)
NTG	6 (3.1)
Steroid induced	4 (2.1)

PXG	6 (3.1)
JOAG	10 (5.2)
Angle recession	4 (2.1)
Duration of anti-glaucoma drug used(year)	5.39±3.5 (1–20)
Anti-glaucoma medication	
Beta-blockers	152 (79.2)
Alpha2 agonists	104 (54.2)
Prostaglandin analogues	168 (87.5)
Topical CAIs	100 (52.1)

Complication	
None	146 (76.1)
IOP spike	44 (22.9)
Iritis	Zero
Hyphema	Zero
Macular edema	Zero
Foveal burn	Zero
Corneal haze	Zero
Hypotony	2 (1.0)

Lens status	
Artificial foldable acrylic IOL	88 (45.8)
Phakic	104 (54.2)

medication after laser	
No	130 (67.7)
Steroid	8 (4.2)
NSAIDs	54 (28.1)

Laser location	
180 degrees	46(24.0)
360 degrees	146 (76.0)
Laser power (mJ)	0.73±0.11 (0.5–1.0)
laser total energy (mJ)	56.83±19.77 (10.2–100)

SLT Indication	
Primary treatment	4 (2.1)
IOP Uncontrolled	152(79.2)
Poor compliance	10 (5.2)
Side effect from medication = S.E	26 (13.5)

Note: Continuous variables were reported as mean ± SD (range) while categorical variables were reported as number (%). **Abbreviations:** SLT, selective laser trabeculoplasty; IOP, intraocular pressure; OHT, ocular hypertension; POAG, primary open-angle glaucoma; NTG, normal tension glaucoma; PXG, pseudoexfoliation glaucoma; JOAG, juvenile open-angle glaucoma; CAIs, carbonic anhydrase inhibitors; NSAIDs, non-steroidal anti- inflammatory drugs; IOL, intraocular lens; SD, standard deviation.

Table 2 Intraocular Pressure and Percentage of Intraocular Pressure Reduction at Each Follow-Up Visit

	IOP	Percentage of IOP Reduction	p-value
	Mean ± SD	Mean ± SD	
Baseline	19.31±3.59		
1-month	15.14±2.93	30.68±27.24	<0.001*
3-month	14.78±3.09	34.29±28.26	<0.001*
6-month	15.31±3.33	30.04±27.24	<0.001*
12-month	14.98±2.62	30.00±27.62	<0.001*
18-month	15.20±3.28	31.27±29.30	<0.001*
24-month	14.79±3.67	32.78±31.53	<0.001*

Notes: Paired *t*-test; *p-value of <0.05 was defined as statistically significant.
Abbreviations: IOP, intraocular pressure; SD, standard deviation.

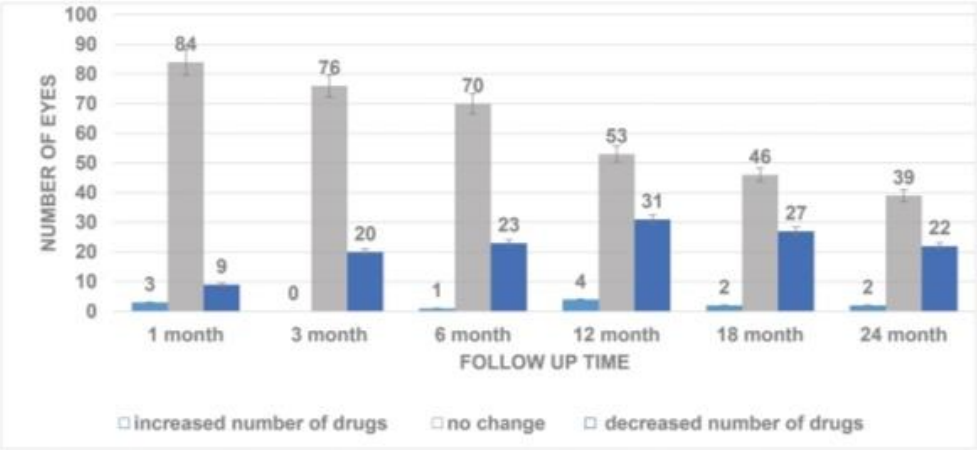


Figure 1 Drugs effect with time

Anti-glaucoma drugs usage after selective laser trabeculoplasty (SLT) at each follow-up visit. Some eyes had antiglaucoma drug withdrawn since a month after SLT and the number of eyes continued increasing in until last follow-up visit. In the majority of treated eyes, medication regime remained unchanged throughout the follow-up period.

DISCUSSION

The quantity of antiglaucoma medications needed dropped dramatically in all follow-up visits in this trial (p 0.001). Over three-months, the overall success rate was 59.4%,

which is comparable to some trials, but lower than others.15,16 3,4 As a result of our research, we

The number of eyes with NTG was rather high, whereas the number of eyes with PXG was quite little. Before SLT, all eyes were provided antiglaucoma medicine with a mean number of antiglaucoma pills of 2.741.09. As a result of uncontrolled IOP medication, the majority of eyes had moderate or advanced glaucomatous damage and required SLT (79.2 percent). SLT success may have been affected by the difficulty reducing IOP in the study population covered by these results. Lee et al.18 found that the total laser energy had an effect on the success rate, and we found that our mean total laser energy was 56.8319.77 mJ.

Aqueous outflow is increased by SLT on the trabecular meshwork (TM) but the mechanism is not fully understood. Gene expression, cytokine release, matrix metalloproteinases activation, and TM remodeling have been shown to be induced by SLT. 19 After SLT, elevated levels of lipid peroxide and decreased antioxidant enzymes may trigger an enhanced inflammatory response, which, in turn, may lead to an abrupt rise in intracranial pressure (IOP). 11 Using both univariate and multivariate analysis, a rise in IOP of greater than 10% at 1 hour after SLT was a positive predictor of SLT success. SLT's continuous biochemical activity on TM, we hypothesized, was represented by a brief elevation in intraocular pressure (IOP) following the procedure. This elevation was also linked to the efficacy of SLT, we reasoned.

Pre-SLT IOP has been found to be a predictor of SLT success in certain research, while another study found the opposite.

2Using both univariate and multivariate analysis, we showed that pre-SLT IOP was a negative predictor of SLT success. We reasoned that the gap was due to the research population's differences in features. 86.46 percent of the eyes in our study required two or more antiglaucoma medications, which were administered to all participants before SLT. SLT was performed on the vast majority of patients whose IOP was not adequately managed by medication (79.2 percent) It's likely that eyes with greater pre-SLT IOP were tough instances that had an effect on how well the SLT procedure worked out. SLT failure has been linked to underlying systemic hypertension. Until now, no one has found any evidence of a link between these two things. Perhaps it's not a direct result of the sickness itself. To a large extent, antihypertensive medications may be responsible. Systemic beta-blockers have been shown to reduce IOP in several investigations. 12 .The List of Essential Medicines recommends the use of systemic beta-blockers to treat hypertension, and internists are frequently prescribing them. According to our research, we didn't have access to this information. Antihypertensive medication effects on SLT outcomes need to be studied further".

Two eyes' IOP elevated by above 5 mmHg an hour after SLT (2.1 percent). After a one-month follow-up, one eye was deemed successful and the impact remained for up to 24 months. Filtering surgery was required for the other eye, which had a constant rise in IOP. However, it was comparable to several other research despite the smaller percentage of IOP spikes observed here than in other of the related ones. 3,4 De Keyser et al reported utilizing a larger overall amount of laser energy in their studies, and we postulated that this could be the cause of the discrepancy.

one of ours, while Lai et al. studied patients with newly diagnosed POAG who had not previously received treatment. IOP was 5 mmHg in one eye at one week following SLT, but there were no complications or severe inflammation. Three antiglaucoma medications were effective in managing this patient's POAG. Due of his medicine intolerance, he was given SLT. There was no evidence of a history of uveitis. There were 94 places where the 0.7 mJ laser power was used. As soon as the antiglaucoma medicines were withdrawn, the IOP reverted to normal levels.

Because the IOP was higher than expected, two antiglaucoma medications were administered two months after SLT to treat it. During the study period, a favorable IOP was obtained. As far as we know, this is the first instance of hypotony following an SLT.

After a year, SLT had lost its effectiveness. At 12, 18, and 24 months, 3.4%, 8.0%, and 4.8% of eyes, respectively, required further laser or surgery. Most eyes (83.8 percent) with medical treatment maintained a good IOP for at least 24 months, which is close to the qualifying success rate reported by Lee et al.6.

The retrospective study design, which was unavoidably biased, limited the power of this investigation. Angle pigmentation, anterior chamber depth, and refractive refraction were not recorded as pre-SLT ocular factors that could have influenced the outcome of the study. There were a number of specialists who performed SLT and the amount of laser energy utilized was determined by the doctor's preference. Follow-up appointments began one month following SLT, therefore it was possible that some issues might be missed during that time period before those visits began. When SLT is indicated and the doctor makes a decision that affects IOP, the antiglaucoma prescription regimen might be modified.

CONCLUSION

Management of glaucoma depends on the underlying condition.cause-and-effect process, with earlier timeframes appearing more frequently open-angle and glaucoma surgeryGlaucoma and angle-closureDespite the growing popularity of SLT and the introduction of Glaucoma's face is being reshaped by the use of MIGS devices.management and reduction of IOPthe basis of eye care is eye dropstreatment. Adherence is a therapeutic restriction that will persist in the long term.Treatments are being developed to lessen the severity of this

RECOMMENDATIONS

•There are five distinct groups of IOP-lowering eye drops.of purpose. Drops like -blockers and -2 agonists, on the other hand, have fewer side effects.Possibly harmful consequences on the entire body. One of the most commonly prescribed medications is acetazolamide IOP-lowering medication is the only one that can be used orally.Refractory glaucoma is the most common usage case for this drug because of its negative effects.• Netarsudil and latanoprostene bunod, two novel eye drops, have been introduced.the Food and Drug Administration of the United States just approved Administration. Both have novel strategies for decreasing IOP and are effective.target the normal aqueous outflow.A gentle procedure, selective laser trabeculoplasty, improves vision.watery outflow is the most common. It can be used as a starting point for a project.to treat glaucoma, as an alternative to eye drops, or to slow its progression a procedure to remove excess fluid.the glaucoma surgery industry has seen a boom

ofinstruments for glaucoma surgery with minimally invasive techniques, which are frequently and sooner in the therapy plan.. further research in the future.

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