

# Comparative study of trabeculectomy using single sutures versus releasable sutures

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**Background:** The purpose of this study was to compare the outcomes of trabeculectomy using single sutures or releasable sutures.

**Methods:** This retrospective study analyzed the medical records of 61 patients who had undergone trabeculectomy using single sutures ( $n = 33$ , 54.1%) or releasable sutures ( $n = 28$ , 45.9%). The scleral flap was secured with a mean 3.9 (range 3–5) single sutures in 33 patients and with three releasable sutures in 28 patients. Primary outcomes were the success rate, based on intraocular pressure and medication usage, and the frequency of complications and post-surgical interventions. The criteria used to determine complete success were, first, intraocular pressure  $< 18$  mmHg and, second,  $\leq 21$  mmHg and  $\geq 20\%$  intraocular pressure reduction without glaucoma medication.

**Results:** All patients had an intraocular pressure  $\leq 21$  mmHg; 87.5% in the single suture group and 92.6% in the releasable suture group had an intraocular pressure  $< 18$  mmHg at 24 months. There was a highly significant reduction in intraocular pressure to baseline values in both groups at the last visit. Applying the first criterion, complete success was achieved in 57.6% of patients with single sutures and 71.4% with releasable sutures, and based on the second criterion, 66.7% and 71.4%, respectively. No significant difference was found between the groups with regard to intraocular pressure, or success or complication rates.

**Conclusion:** The results of trabeculectomy using single sutures or releasable sutures are equivalent. Therefore, the choice of suture technique should be based on individual patient requirements and surgeon experience.

**Keywords:** glaucoma surgery, trabeculectomy, releasable suture, laser suture lysis

## Introduction

At present, trabeculectomy is the most commonly performed and effective surgical method for medically uncontrolled glaucoma.<sup>1</sup> However, suture adjustment and bleb interventions are frequently necessary after trabeculectomy.<sup>1–5</sup> In particular, the use of mitomycin C requires tight suturing of the scleral flap to prevent postoperative hypotony.<sup>5</sup> Therefore, several modifications of trabeculectomy have been described, suggesting variation in shapes and sizes of the scleral flap, use of antimetabolites, and use of laserable, releasable, or adjustable sutures.<sup>6–11</sup> The aim of this study was to compare the reduction in intraocular pressure achieved using either laser lysis of standard single sutures or removal of releasable sutures after trabeculectomy, with consideration of their advantages and disadvantages. In addition, we assessed the incidence of complications and further surgical interventions for outflow adjustment at the scleral flap site.

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## Materials and methods

### Patients

We retrospectively analyzed the medical records of 61 consecutive patients who underwent trabeculectomy with mitomycin C using either standard single sutures or releasable sutures between January 2008 and January 2009 at the University Eye Hospital, Wuerzburg, Germany. Baseline information was reviewed for each patient, including age, gender, localization of eye undergoing surgery, type of glaucoma, and ocular medication. Preoperatively, all patients underwent a standard ophthalmic examination to obtain best corrected visual acuity, which was converted to the logarithm of the minimum angle of resolution (logMAR), intraocular pressure using Goldmann applanation tonometry, angle grading by gonioscopy, slit-lamp biomicroscopy for anterior segment examination, and indirect ophthalmoscopy for assessment of the optic nerve head and peripheral retina. Inclusion criteria were medically uncontrolled primary or secondary open-angle or angle-closure glaucoma treated with trabeculectomy and mitomycin C with single sutures or releasable sutures between January 2008 and January 2009.

Exclusion criteria included congenital glaucoma or secondary glaucoma, such as neovascular glaucoma or glaucoma associated with iridocorneal endothelial syndrome, second trabeculectomy, and more than two cyclodestructive procedures or laser trabeculoplasties prior to trabeculectomy, and use of both single and releasable sutures to secure the scleral flap.

### Surgical technique

Details of the surgical procedure used have been described previously.<sup>9–12</sup> Trabeculectomy with laserable sutures was performed by four experienced glaucoma surgeons and with releasable sutures by a single glaucoma surgeon. A corneal traction suture was placed at 6 o'clock, and a fornix-based conjunctival flap was created.<sup>7</sup> Episcleral blood vessels were then cauterized. Four sponges (2 × 8 mm) soaked in different concentrations of mitomycin C depending on the individual risk of scarring were placed under the conjunctival flap for 3 minutes. The majority of patients in each group received mitomycin C 0.02%, ie, 27 patients (81.8%) in the single suture group and 22 patients (78.6%) in the adjustable suture group. Mitomycin C 0.01% was used in four eyes (14.3%) with releasable sutures and in three eyes (9.1%) with single sutures. Sponges soaked in mitomycin C 0.05% were placed in two eyes (7.1%) in the releasable suture group and in three eyes (9.1%) in the single suture group. There was no statistically significant difference in the amount of mitomycin C

used between the groups ( $P = 0.531$ ). The area of application was then washed with 30 mL of balanced saline solution. Thereafter, a rectangular scleral flap measuring 4 × 3 mm was dissected and a trabeculectomy of 0.8 × 2 mm was performed followed by an iridectomy. The scleral flap was fixed with single sutures or releasable sutures. Single sutures were placed at both corners of the scleral flap and towards the center of one or two sides. Additional sutures were placed if needed. The mean number of single sutures used was 3.9 (range 3–5) in 33 eyes from 61 patients (54.1%). The scleral flap was secured with three releasable sutures to allow suture removal in 28 patients (45.9%), as shown in the video <http://dypr.es/JAPzcw>. Finally, the conjunctiva was closed with a 10.0 nylon running mattress suture.<sup>11</sup>

### Postoperative management

All patients received topical prednisolone acetate every 1–2 hours for a week tapering over 6–8 weeks, antibiotics, such as gentamicin three times daily for one week or as needed, and a cycloplegic agent, such as atropine twice per day for 1–2 weeks. All antiglaucomatous medication was discontinued after surgery. Patients were followed up at day 1, weeks 1 and 4, months 3, 6, and 12, and at the final follow-up visit (at a mean  $24.9 \pm 5.5$  months for the single suture group and  $23.9 \pm 5.3$  months for the releasable suture group), with additional visits whenever necessary, for documentation of intraocular pressure, number of intraocular pressure-lowering drugs, best corrected visual acuity, results of anterior and posterior segment examination, frequency of complications and postsurgical interventions, and filtering bleb score, ie, the Wuerzburg Bleb Classification Score (WBCS).<sup>13</sup> The WBCS is an objective grading system for assessment of the appearance of a filtering bleb and is used to decide whether to treat an imminent bleb scarring earlier. It contains several parameters, ie, vascularization, corkscrew vessels, encapsulation, and microcysts, each scored 0 to 3. The total bleb score is calculated as the sum of each parameter. Patients with a higher bleb score have better clinical morphology of the filtering bleb and a lower postoperative intraocular pressure.<sup>13</sup> Laser suture lysis of single sutures<sup>10–12,14</sup> or removal of releasable sutures<sup>10,19–21</sup> was undertaken in patients with increased intraocular pressure and flat filtering blebs which inflated after ocular massage, and in patients who did not reach their target intraocular pressure. Ocular massage immediately posterior to the scleral flap was performed to produce aqueous flow through the fistula under the conjunctiva.

Further intensive postoperative care to control wound healing included increased application of topical steroids,

early bleb injections of 5-fluorouracil at the beginning of bleb scarring, and needling for encapsulated blebs, as proposed by Marquardt et al in 2004.<sup>16</sup> Subconjunctival injections of 5-fluorouracil were repeatedly applied according to the WBCS.<sup>13</sup>

Two criteria for complete success were defined according to the World Glaucoma Association guidelines:

- intraocular pressure  $\leq 21$  mmHg and an intraocular pressure reduction  $\geq 20\%$  versus baseline values without antiglaucomatous medication or
- intraocular pressure  $< 18$  mmHg without glaucoma medication.

Qualified success was determined, fulfilling the above-mentioned criteria with or without intraocular pressure-lowering medication.

## Statistical analysis

SPSS® version 19.0 for Windows (SPSS Inc, Chicago, IL) was used for statistical analyses and to create the accompanying figures. Analyses of variance for repeated measurements were used to examine intraocular pressure. The Student's *t*-test was used for continuous variables with normal distribution. Otherwise, differences in single discrete variables between groups were tested for significance using the Mann-Whitney U-test. Categorical variables were evaluated using the  $\chi^2$  (Fisher's Exact) test. A maximum two-tailed *P* value of  $< 0.05$  was considered to indicate statistical significance.

## Results

The approach of using single sutures for scleral flap tying was performed in 33 eyes (54.1%). Releasable sutures were placed in 28 eyes (45.9%). Both groups were comparable with regard to sample size, gender, age, preoperative intraocular pressure, number of preoperative medications, and type of glaucoma (Table 1). The last follow-up visit occurred on average at  $24.9 \pm 5.5$  months and at  $23.9 \pm 5.3$  months for patients with single sutures and releasable sutures, respectively. Baseline data and surgical outcomes at 12 months and at the last follow-up visit are summarized in Table 2.

## Intraocular pressure

Figure 1 shows changes in intraocular pressure during follow-up for both groups. The mean preoperative intraocular pressure was  $25.9 \pm 10.7$  mmHg in the single suture group and  $28.8 \pm 8.9$  mmHg in the releasable suture group ( $P = 0.269$ ). We observed a highly significant reduction of intraocular pressure at all times in both groups compared with the preoperative intraocular pressure ( $P < 0.0001$ ). Intraocular pressure

was  $12.8 \pm 4.0$  mmHg in the single suture group and  $13.0 \pm 3.6$  mmHg in patients with releasable sutures at the last follow-up visit. Moreover, there was no significant difference in intraocular pressure between the single suture group and the releasable suture group during follow-up ( $P = 0.776$ , Table 2).

Removal of releasable sutures or laser suture lysis of single sutures was performed in the event of inadequate filtration and unacceptable intraocular pressure. Twelve patients (42.9%) in the releasable suture group needed release of sutures, most often during the first week after trabeculectomy (range 1–27 days). Removal of one releasable suture was performed under slit-lamp with topical anesthesia in nine patients after  $5.8 \pm 7.4$  days, and a second suture was released in three patients after  $25.7 \pm 21.1$  days. Laser suture lysis of the first single suture was necessary in 18 patients (54.6%) with single sutures, mostly within the first 7 (range 1–79) days. Additionally, nine patients (27.3%) underwent laser suture lysis of a second suture and four patients (12.1%) had laser suture lysis of a third suture.

## Medication

Preoperatively, 63.6% of patients with single sutures and 78.6% with releasable sutures received  $3.0 \pm 1.2$  and  $3.0 \pm 1.0$  topical glaucoma medications, respectively. Prior to scheduled surgery, 12 patients with single sutures and six patients with releasable sutures were on systemic glaucoma medication (acetazolamide) after topical medication was discontinued. Seven patients (21.2%) with single sutures needed  $0.3 \pm 0.7$  (range 1–2) topical antiglaucomatous medications at the 12-month visit and eight patients (24.2%) received  $0.4 \pm 0.8$  (range 1–3) medications at the last visit. In contrast, six patients (21.4%) in the releasable suture group were on  $0.6 \pm 1.3$  (range 1–4) topical medications after 12 months and eight patients (28.6%) on  $0.7 \pm 1.4$  (range 1–4) topical medications at the last follow-up visit. No statistically significant difference in postoperative need for glaucoma medication was found between the two groups during follow-up (Table 2).

## Qualified success

According to the criteria for qualified success, 26 patients (78.8%) with single sutures had an intraocular pressure of 21 mmHg or less and at least a 20% reduction in intraocular pressure to baseline measures and 29 patients (87.9%) had an intraocular pressure of less than 18 mmHg at the last follow-up visit. In the releasable suture group, 26 patients (92.9%) fulfilled both criteria for a qualified success at the

**Table 1** Group characteristics

	Single suture group	Releasable suture group	P value
Patients (n, %)	33 (54.1)	28 (45.9)	
Eyes (n, %)	33 (54.1)	28 (45.9)	
Eye (%)			
Right	17 (51.5)	10 (35.7)	0.216 <sup>a</sup>
Left	16 (48.5)	18 (64.3)	
Age (years)			
Mean $\pm$ SD	63.3 $\pm$ 9.3	64.9 $\pm$ 8.9	0.501 <sup>b</sup>
Range	40–78	41–79	
Gender (%)			
Male	18 (54.5)	10 (35.7)	0.141 <sup>a</sup>
Female	15 (45.5)	18 (64.3)	
BCVA (logMAR)			
Mean $\pm$ SD	0.26 $\pm$ 0.38	0.33 $\pm$ 0.42	0.534 <sup>b</sup>
Range	–0.10–1.54	–0.10–1.40	
IOP (mmHg)			
Mean $\pm$ SD	25.9 $\pm$ 10.7	28.8 $\pm$ 8.9	0.269 <sup>b</sup>
Range	13–60	15–54	
Patients on topical medication (n, %)	21 (63.6)	22 (78.6)	
Patients on systemic medication (n, %)	12 (36.4)	6 (21.4)	
Patients on topical glaucoma medication (n, %)			
Mean $\pm$ SD	3.0 $\pm$ 1.2	3.0 $\pm$ 1.0	0.889 <sup>b</sup>
Range	0–5	0–5	
Type of glaucoma (%)			
Primary open-angle	19 (57.6)	15 (53.6)	0.272 <sup>a</sup>
Pseudoexfoliative	8 (24.2)	12 (42.8)	
Normal tension	2 (6.1)	0 (0)	
Pigmentary dispersion	2 (6.1)	0 (0)	
Chronic angle-closure	1 (3.0)	1 (3.6)	
Traumatic	1 (3.0)	0 (0)	
Previous ocular surgery (%)			
Laser trabeculoplasty	15 (45.5)	6 (21.4)	0.281 <sup>a</sup>
Cyclodestructive	3 (9.1)	5 (17.9)	
Peripheral iridotomy/iridectomy	5 (15.2)	6 (21.4)	
Phaco	4 (12.1)	7 (25.0)	
Follow-up last visit			
Mean $\pm$ SD	24.9 $\pm$ 5.5	23.9 $\pm$ 5.3	0.497 <sup>b</sup>

**Notes:** Absolute values (percentage), unless stated otherwise. <sup>a</sup> $\chi^2$  (Fisher's Exact) test; <sup>b</sup>two-paired t-test.

**Abbreviations:** SD, standard deviation; IOP, intraocular pressure; BCVA, best-corrected visual acuity; logMAR, log of the minimum angle of resolution; n, sample size; phaco, clear cornea phacoemulsification and posterior chamber intraocular lens implantation.

last visit. Statistical analysis showed no statistically significant differences between the groups (Table 2, Figure 2).

## Complete success

Complete success was achieved by 19 patients (57.6%) with single sutures, by having an intraocular pressure of 21 mmHg or less and at least a 20% reduction of intraocular pressure, whereas 22 patients (66.7%) had an intraocular pressure of less than 18 mmHg at the last visit. Overall, 20 patients (71.4%) with releasable sutures had complete success, fulfilling both criteria (Figure 3A and B). Although there was a slight tendency for a higher success rate using releasable sutures, no statistically significant difference in complete success was found between the groups at any time point (Table 2).

## Visual acuity

Mean best corrected visual acuity at the last visit was  $0.39 \pm 0.42$  logMAR in the single suture group and  $0.50 \pm 0.46$  logMAR in the releasable suture group. Visual acuity was not significantly decreased compared with baseline or any of the follow-up visits ( $P = 0.958$ , one-way analysis of variance). Moreover, no statistical significance was found between the groups at any time point (Table 2).

## Suture and bleb interventions

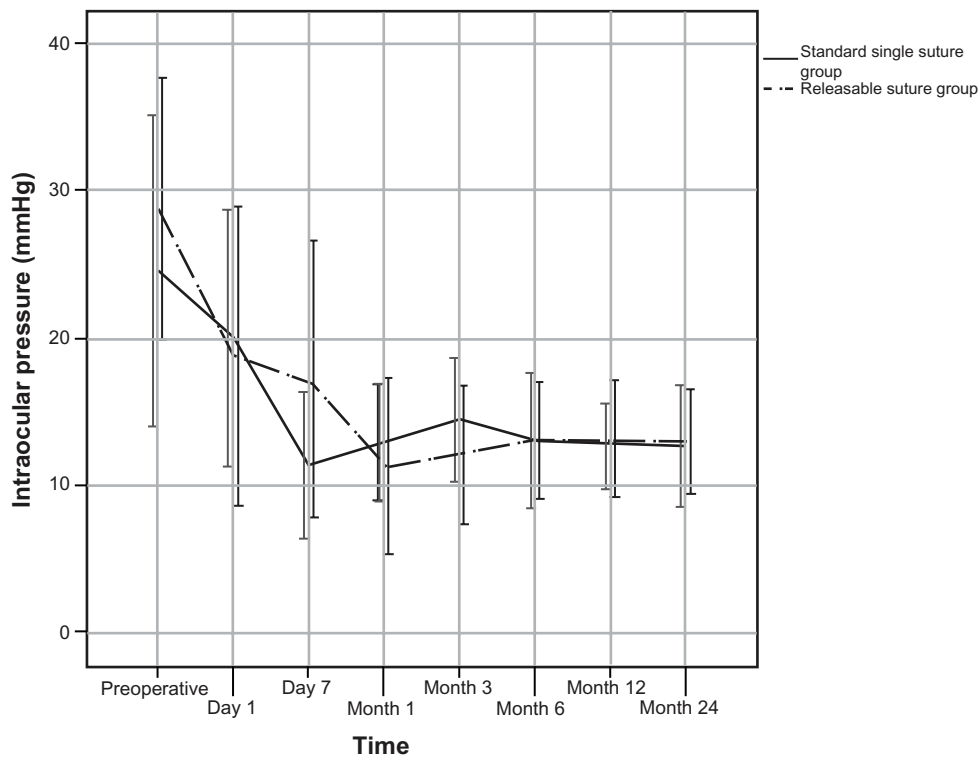
Suture and bleb manipulations following trabeculectomy are shown in Table 3. Bleb needling was performed in 10 eyes (30.3%) in the single suture group and in four eyes (14.3%)

**Table 2** Data preoperatively and at 12 and 24 months

	Single suture group	Releasable suture group	P value
<b>Preoperative</b>			
BCVA (logMAR)	0.26 ± 0.38	0.33 ± 0.42	0.534 <sup>b</sup>
IOP (mmHg)	25.9 ± 10.7	28.8 ± 8.9	0.269 <sup>b</sup>
Glaucoma medications (n)	3.0 ± 1.2	3.0 ± 1.0	0.889 <sup>b</sup>
<b>At 12 months</b>			
BCVA (logMAR)	0.39 ± 0.41	0.41 ± 0.45	0.832 <sup>b</sup>
IOP (mmHg)	13.1 ± 2.9	13.0 ± 4.1	0.883 <sup>b</sup>
Qualified success [n (%)]			
≤21 mmHg + 20% IOP ↓	29 (87.9)	25 (89.3)	1.000 <sup>a</sup>
<18 mmHg	31 (93.9)	25 (89.3)	0.653 <sup>a</sup>
Glaucoma medications (n)	0.3 ± 0.7	0.6 ± 1.3	0.386 <sup>b</sup>
Complete success [n (%)]			
≤21 mmHg + 20% IOP ↓	22 (66.7)	22 (78.6)	0.394 <sup>a</sup>
<18 mmHg	25 (75.8)	21 (75.0)	1.000 <sup>a</sup>
<b>At the last visit</b>			
BCVA (logMAR)	0.39 ± 0.42	0.50 ± 0.46	0.297 <sup>b</sup>
IOP (mmHg)	12.8 ± 4.0	13.0 ± 3.6	0.852 <sup>b</sup>
Qualified success [n (%)]			
≤21 mmHg + 20% IOP ↓	26 (78.8)	26 (92.9)	0.160 <sup>a</sup>
<18 mmHg	29 (87.9)	26 (92.9)	0.418 <sup>a</sup>
Glaucoma medications (n)	0.4 ± 0.8	0.7 ± 1.4	0.277 <sup>b</sup>
Complete success [n (%)]			
≤21 mmHg + 20% IOP ↓	19 (57.6)	20 (71.4)	0.296 <sup>a</sup>
<18 mmHg	22 (66.7)	20 (71.4)	0.785 <sup>a</sup>

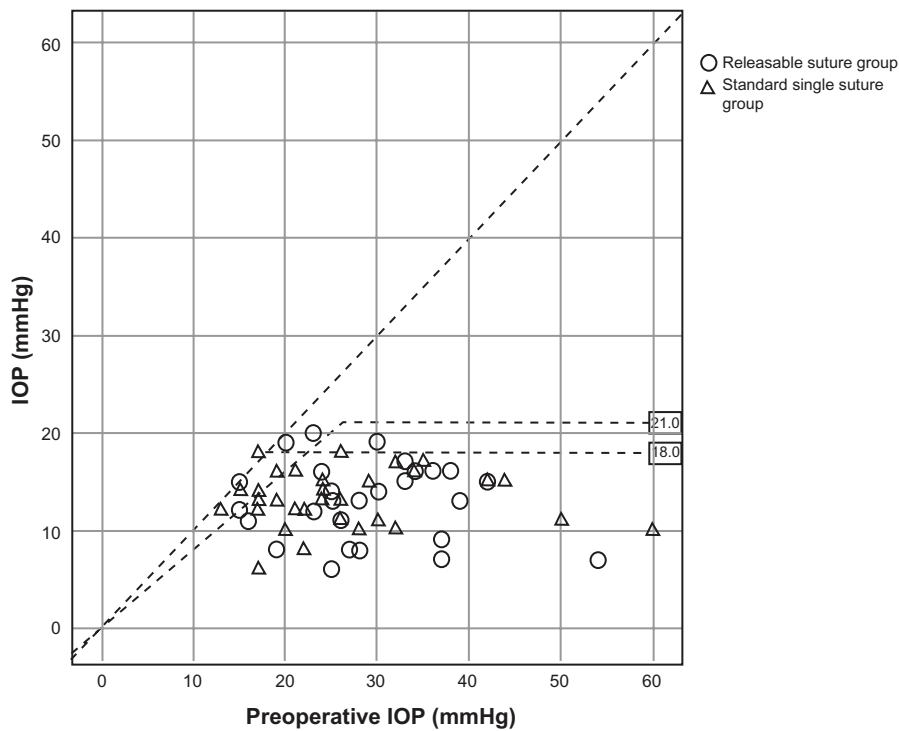
**Notes:** Absolute values (percentage) and mean values ± SD, unless stated otherwise. <sup>a</sup>χ<sup>2</sup> (Fisher’s Exact) test; <sup>b</sup>two-paired t-test.

**Abbreviations:** IOP, intraocular pressure; BCVA, best-corrected visual acuity; logMAR, log of the minimum angle of resolution; SD, standard deviation.



**Figure 1** Intraocular pressure development during follow-up for both groups.

**Notes:** Highly significant reduction in postoperative intraocular pressure was obtained at each visit in both groups ( $P < 0.0001$ ). Intraocular pressure was not statistically significant between the groups during follow-up. The plot illustrates mean values as the center and standard deviation as the upper and lower lines.

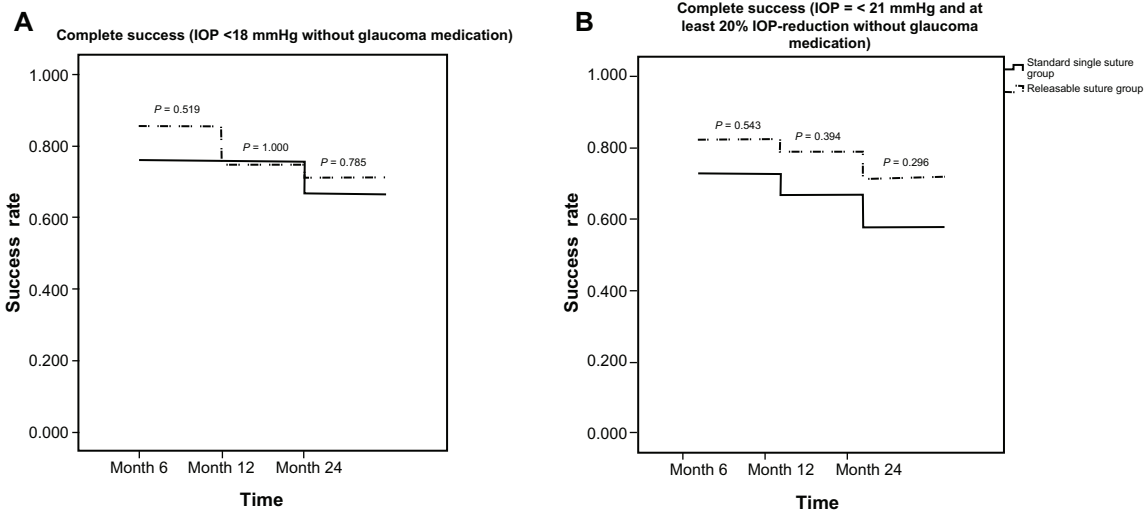


**Figure 2** Scatter plot of intraocular pressure results at 12 months postoperatively compared with baseline for each eye.  
**Notes:** Eyes above the oblique line have a higher postoperative intraocular pressure at 12 months compared with preoperative values. Additionally, points falling below the line labeled with 21 mmHg or 18 mmHg have fulfilled both criteria for success with and without glaucoma medication (qualified success).  
**Abbreviations:** IOP, intraocular pressure.

in the releasable suture group ( $P = 0.089$ ). Nearly all patients in both groups needed injections of 5-fluorouracil to prevent bleb scarring, ie, 29 patients (92.9%) in the single suture group and 24 patients (87.9%) in the releasable suture group. The mean number of 5-fluorouracil injections was  $5.8 \pm 3.6$  (range 0–15) in patients with standard single sutures and  $6.6 \pm 5.1$  (range 0–18) in patients with releasable sutures ( $P = 0.133$ ).

### Complications and postsurgical interventions

The incidence of complications and postoperative interventions following trabeculectomy are shown in Tables 4 and 5. Postoperative ophthalmic examination revealed a flat anterior chamber in three patients (9.1%) in the single suture group and in one patient (3.6%) in the releasable suture group.



**Figure 3** Probability of complete success at months 6 and 12 and at the last visit. **(A)** Intraocular pressure < 18 mmHg without glaucoma medication. **(B)** Intraocular pressure  $\leq 21$  mmHg and at least 20% intraocular pressure reduction without glaucoma medication.  
**Abbreviations:** IOP, intraocular pressure.



**Table 3** Suture and bleb interventions

	Single suture group	Releasable suture group	P value*
Laser suture lysis of single sutures (n)	18 (54.6)	–	–
Removal of releasable sutures	–	12 (42.9)	–
5-FU bleb injections	29 (92.9)	24 (87.9)	
Mean number of 5-FU $\pm$ SD	5.8 $\pm$ 3.6	6.6 $\pm$ 5.1	0.133
Bleb needling	10 (30.3)	4 (14.3)	0.089

**Notes:** Absolute values (percentage) and mean values  $\pm$  SD. \* $\chi^2$  (Fisher's Exact) test.

**Abbreviations:** SD, standard deviation; 5-FU, 5-fluorouracil.

Treatment of a shallow anterior chamber using sodium hyaluronate injection (Healon<sup>®</sup>, Abbott Laboratories Inc., Abbott Park, Illinois, USA) was required by two patients (6.1%) in the single suture group and by none in the releasable suture group. Conjunctival wound leakage needing suturing of the conjunctiva was identified in four eyes (12.1%) from patients in the single suture group and in two eyes (7.1%) from patients in the releasable suture group. Seven of 33 patients (21.2%) with single sutures had transient hypotony (intraocular pressure  $\leq$  5 mmHg) for a mean duration of  $5.3 \pm 4.2$  days. Postoperative hypotony lasting longer than  $2.8 \pm 2.1$  days was found in eight patients (28.6%) with releasable sutures. There was no statistically significant difference in duration of hypotony between the groups ( $P = 0.178$ ). Scleral flap revision with additional sutures for persistent hypotony and to reduce the risk of choroidal detachment was performed in three patients (9.1%) in the single suture group and in three patients (10.7%) in the releasable suture group. No statistically significant difference was found between the two groups with regard to complications and postsurgical interventions.

## Discussion

Trabeculectomy is still considered the gold standard for medically uncontrolled glaucoma.<sup>9,17</sup> Therefore, several modifications and variations have been developed to maximize the benefits of treatment while minimizing adverse events.<sup>6–11</sup> In trabeculectomy, aqueous outflow is determined

by the size, shape, and position of the scleral flap<sup>8</sup> use of antimetabolites,<sup>2,18</sup> suture position, tension, and application of laserable, adjustable, or releasable sutures,<sup>9–12,14,15</sup> thereby having an impact on success of treatment based on intraocular pressure, medication required, occurrence of complications, and postoperative bleb and suture management. The technique of flap closure with different types of sutures using either single sutures cut with laser lysis,<sup>14</sup> sutures released by corneal incision,<sup>19,20</sup> or sutures that can be transconjunctivally adjusted,<sup>6,9,15</sup> should be loose enough to permit aqueous outflow but tight enough to reduce complications related to excessive filtration.<sup>10,21</sup> Previous studies have evaluated the relative merits of laserable, releasable, or adjustable sutures.<sup>10,12</sup> The releasable suture technique was shown to be an effective and safe method of providing sufficient aqueous humor outflow by easily removing the sutures with forceps.<sup>19–21</sup> However, complications have been described, including foreign body irritation and keratopathy due to exposed sutures, conjunctival leakage after suture removal, or endophthalmitis caused by externalized sutures that are contaminated with bacteria.<sup>6,10,15,19–21</sup> In our study, we investigated the advantages and disadvantages of releasable sutures compared with laser suture lysis of single sutures in trabeculectomy. Our results are based on two comparable groups with a follow-up of 2 years. The data illustrate that both surgical techniques are equally effective, with low complication rates and adequate reduction of intraocular pressure.

**Table 4** Incidence of postoperative complications

	Single suture group	Releasable suture group	P value*
Hypotony ( $\leq$ 5 mmHg)	7 (21.2)	8 (28.6)	–
Duration (mean $\pm$ SD, days)	5.3 $\pm$ 4.2	2.8 $\pm$ 2.1	0.178
Conjunctival leakage	5 (15.2)	5 (17.9)	1.000
Shallow anterior chamber	3 (9.1)	1 (3.6)	0.385
Hyphema	2 (6.1)	1 (3.6)	0.654
Choroidal detachment	5 (15.2)	2 (7.1)	0.437
Blebitis/endophthalmitis	0 (0)	0 (0)	–

**Notes:** Absolute values (percentage) and mean values  $\pm$  SD. \* $\chi^2$  (Fisher's Exact) test.

**Abbreviation:** SD, standard deviation.

**Table 5** Postsurgical interventions

	Single suture group	Releasable suture group	P value*
Bleb needling	10 (30.3)	4 (14.3)	0.089
Conjunctival leakage requiring suturing	4 (12.1)	2 (7.1)	0.678
Iris incarceration needing iris revision	0 (0)	3 (10.7)	0.091
Scleral flap revision	3 (9.1)	3 (10.7)	1.000
Healon® injections into anterior chamber	2 (6.1)	0 (0)	0.495
Additional IOP-lowering procedures			
Laser trabeculoplasty	2 (6.1)	0 (0)	0.495
Cyclodestructive methods	0 (0)	0 (0)	–
Retrabeculectomy	0 (0)	0 (0)	–

**Notes:** Absolute values (percentage). \* $\chi^2$  (Fisher's Exact) test.

**Abbreviation:** IOP, intraocular pressure.

A study by Aykan et al,<sup>10</sup> in which the surgical outcomes of laser suture lysis of single sutures and removal of releasable sutures were compared, revealed no differences in efficacy or complication rates between the groups. While single sutures were used in both groups, the flap of one group was additionally secured by two releasable sutures. Aykan et al used 2–4 single sutures in addition to two releasable sutures on two sides of the scleral flap (releasable suture group). This is in contrast with our study comparing outcomes of patients with either single sutures or releasable sutures. Moreover, we found highly significant intraocular pressure reductions in both groups during follow-up. In addition, evaluation of success revealed no significant differences between the groups. This is consistent with the findings reported by Aykan et al.<sup>10</sup> In our series, complications and revisions were few, relatively minor for both methods, and compare favorably with the findings of other studies.<sup>10,12,19,20</sup> Furthermore, we found comparable complication rates between the single suture and releasable suture groups. This is in line with previously published data comparing different types of sutures in trabeculectomy, ie, laser suture lysis of single sutures, removal of releasable sutures, or adjustment of sutures.<sup>10,12</sup> The endophthalmitis and blebitis described in early studies after filtration surgery were not encountered in our cases.<sup>2,4,5</sup>

In practice, focal massage immediately posterior to the filtering bleb allows adjustment of the scleral flap and increases filtration through the fistula. Accordingly, suture adjustment for controlling intraocular pressure in the early postoperative period is indicated after successful bleb massage. While single sutures require laser suture lysis that may lead to subsequent inflammation of the conjunctiva, Tenon's capsule, and the sclera, as well as conjunctival leak and sudden collapse of the anterior chamber, the adjustment of sutures as well as removal of releasable sutures have been reported to allow controlled reduction of intraocular pressure.<sup>12,15</sup> However,

we found no significant difference regarding complications induced by laser suture lysis or removal of sutures. Previous studies have favored tying of the scleral flap with adjustable sutures, allowing safer control of intraocular pressure and minimizing the risk of postoperative hypotony.<sup>9,12</sup> There has been one report of a longer duration of ocular hypotony in patients with single sutures,<sup>10</sup> but there was no statistically significant difference in duration of ocular hypotony between groups in our study.

Our study has some limitations, first related to the fact that our data were collected retrospectively, so is more likely than prospective studies to have more sources of error due to confounding and bias. However, although trabeculectomy was performed by more than one surgeon, postoperative care was identical for all patients included in the present study. Despite the limitations imposed by inclusion of surgical data recorded by different surgeons, the groups of patients were comparable with regard to sample size, gender, age, preoperative intraocular pressure, medication usage, and diagnosis of glaucoma. Many questions remain regarding possible parameters influencing the long-term outcome of both techniques. Therefore, additional prospective studies with greater statistical power to detect small differences will be needed to establish and improve the methods used at the scleral flap site.

In summary, we have shown that trabeculectomy with either single sutures or releasable sutures is an efficient surgical procedure for reduction of intraocular pressure in the medium term. Reduction of intraocular pressure, and success and complication rates, were similar in this study, regardless of whether eyes received single sutures or releasable sutures.

## Disclosure

The authors report no conflicts of interest in this work.



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