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Laser suture lysis after tight scleral flap filtration surgery

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To demonstrate the efficacy and safety of laser suture lysis after tight scleral flap closure in trabeculectomy, alone or combined with cataract extraction, 22 patients were treated and evaluated. Thirteen patients underwent tight scleral trabeculectomy, and 9 underwent a trabeculectomy combined with extracapsular cataract extraction. An intraocular pressure of 25.68 mmHg before laser suture lysis was immediately dropped to 9.68 mmHg, with elevation of the filtering bleb. Postoperative intraocular pressure was controlled at 12.23 mmHg at a mean of 10.32 weeks follow-up whereas preoperative intraocular pressure was 26.05 mmHg. No serious complications were experienced except that 3 cases had temporary hypotony which was spontaeously resolved within a week without consequence. The technique of tight scleral flap trabeclectomy with subsequent laser suture lysis appears to allow serial release of resistance to aqueous outflow to achieve the desirable low level of intraocular pressure while minimizing complications. It offers a more predictable and controllable filtration.

Key words: *Suture lysis, Laser, Filtration surgery, Tight scleral flap.*

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การทำ filtration surgery เป็นการผ่าตัดที่นิยมที่สุดในการรักษาโรคต้อหิน แต่มักจะประสบปัญหาความไม่พอดีของการระบายน้ำ aqueous เพื่อลดความดันภายในลูกตาของผู้ป่วย คณะผู้วิจัยได้เสนอถึงวิธีการผ่าตัด filtration surgery ในแบบที่เรียกว่า trabeculectomy หรือร่วมกับการทำ extracapsular cataract extraction โดยการเย็บแผล scleral flap ให้แน่น แล้วจึงเลือกตัดไหมด้วยเลเซอร์ ในระยะหลังผ่าตัด เพื่อเป็นการปรับลดความดันตาให้อยู่ในเกณฑ์ที่ต้องการ โดยรายงานผู้ป่วย 22 ราย พบว่าสามารถลดความดันตาในระยะหลังผ่าตัดก่อนยิงเลเซอร์จาก 20.68 มิลลิเมตรปรอท ลงเหลือ 9.68 มิลลิเมตรปรอท และสามารถควบคุมความดันตาให้อยู่ที่ระดับ 12.23 มิลลิเมตรปรอทลดลงจากความดันก่อนการผ่าตัด 26.05 มิลลิเมตรปรอท โดยติดตามผู้ป่วยไปนานเฉลี่ย 10.32 สัปดาห์ และไม่พบว่ามีภาวะแทรกซ้อนของ flat anterior chamber ดังที่เคยมีรายงานมาก่อน

โดยสรุป การผ่าตัด filtration surgery โดยการใช้ tight scleral flap closure ร่วมกับ laser suture lysis ทำให้จักษุแพทย์สามารถจะควบคุมความดันตาหลังผ่าตัด ให้อยู่ในเกณฑ์ที่ต้องการได้ดีขึ้น โดยสามารถปรับลดความดันตาได้ตามลำดับ หลีกเลี่ยงภาวะแทรกซ้อนที่มักจะเกิดขึ้นได้ และน่าจะได้มีการนำมาใช้ให้แพร่หลายทั่วไป

Glaucoma is the second leading cause of blindness in Thailand.[1] Uncontrolled high intraocular pressure (IOP) is the major risk factor that causes glaucomatous damage to the optic nerve head. Thus the general approach is to reduce the IOP to a certain level either medically, by laser or surgically. Filtration surgery is the most common surgical procedure being performed in the treatment of glaucoma. It involves the formation of a fistula connecting the anterior chamber and the subconjunctival space, with subsequent effective reduction of IOP. Currently, two different approaches are employed. The first is a full-thickness filtration in which a full-thickness sclerostomy is made to connect the anterior chamber directly to the subconjunctival space. The problem with this technique is over-drainage of aqueous fluid from the anterior chamber which causes anterior chamber flattening, prolonged hypotony, peripheral anterior synechiae, cataract formation and corneal decompensation.[2,3] The second approach is a partial thickness filtration or trabeculectomy in which the sclerostomy is performed under a scleral flap, which is later sutured back to its original scleral bed in an attempt to minimize aqueous over-drainage. The advantage of trabeculectomy is the tamponade effect provided by the dissected and resutured sclera over the sclerostomy, with subsequent reduction of aqueous flow-through. However, the postoperative IOP control is not as effective as in the first approach, especially in long term follow-up.[4] Also,the technique itself somehow does not eliminate the problem of over-drainage if the surgeon sutured the scleral flap loosely.

To benefit from the advantages of both techniques, and minimize complications, tight scleral flap suture closure and later selective laser suture lysis have been used to achieve a desirable IOP level postoperatively. Although the technique of laser suture lysis has been previously reported in western literature[5-7]only a single study[8] combined the tight scleral flap closure with the laser technique. All studies reported some complications with their techniques. There has never been such

Table 1. Characteristics of the study population and procedures.

		Number (%)
Sex:	Male	14(63.3)
	Female	8(36.4)
Diagnosis:		
	Primary open-angle glaucoma	10(45.5)
	Chronic angle closure glaucoma	9(40.9)
	Secondary glaucoma	3(13.6)
Surgery procedure:		
	Trabeculectomy	13(59.1)
	Combined cataract ectraction with intraocular lens and trabeculectomy	9(40.9)

a report in the oriental literature discussing this technique. We present our method of combined tight scleral filtration surgery and laser suture lysis for its benefits in efficacy and reduction of complications.

Subjects and methods

From August 1992 to September 1993, twenty-two patients received laser suture lysis treatment after tight scleral flap trabeculectomy. The group included 14 men and 8 women, and the mean age of the patients was 61.2 years which ranged from 12 to 86 years. The diagnosis and procedures used are shown in table 1. There were 10 primary open angle glaucomas, nine chronic angle closure glaucomas and 3 cases of secondary glaucoma. Thirteen eyes had trabeculectomy alone and the remaining had trabeculectomy combined with extracapsular cataract extraction.

All surgical procedures were performed by one of us (PR). The surgical steps for trabeculectomy were as follows: 1) subconjunctival injection of 0.2 ml of 2% lidocaine with adrenaline 1:200,000 with a 27 guage needle, 2) no retrobulbar or peribulbar block was done, 3) a limbal-based conjunctival flap was dissected superonasally or superotemporally, 4) hemostasis was achieved with the use of bipolar microcautery, 5) no tenonectomy was performed, 6) a 2.5 x 4.0 mm rectangular scleral flap was dissected, half scleral thickness in depth, using a Beaver #64 blade, 7) a beveled paracentesis was made with a Beaver #75 blade at either the 3:00 or 9:00 o'clock position. In high-risk cases, a mitomycin C soaked Weck's cellulose sponge was applied over and under the scleral flap to enhance the filtration function, 8) a 1x 2 mm rectangular trabeculectomy was performed under the scleral flap using either a Beaver #75 blade or a Kelly's descemet punch followed by basal peripheral iridectomy with iris scissors, 9) the scleral flap was with closed 3-7 stitches, mostly 4 stitches, with black nylon 10-0 (Ethilon^{R} 10-0), 10) the conjunctiva was closed with continuous running sutures using a Vicryl 8-0 round needle, 11) the wound and filtration was carefully checked by injecting balanced salt solution through the side port incision, then antibiotic-steroid eye ointment was applied to the cornea and the eye was patched and shielded.

For combined extracapsular cataract extraction and trabeculectomy, the procedures were performed as described by Shields[9] with some modifications. A fornix-based conjunctival flap, instead of the limbal-based flap, was used to ease maneuverability. The corneoscleral flap was dissected 2 mm posterior to limbus superiorly and extended in a curvilinear fashion to the side toward the surgical limbus. The total wound length was 10 mm. A Kelly's descemet punch was used to create a sclerectomy in the posterior lip of the corneoscleral incision at the 12:00 o'clock position. The scleral flap adjacent to the sclerectomy was closed by using at least 3 stitches to create a rather tight scleral flap closure. The conjunctival flap was closed with two 8-0 Vicryl^{R} sutures anchored at each side of the corneoscleral limbus.

The IOP was measured on the day after the surgery. In case of underfiltration, laser suture lysis was then performed. Underfiltration was defined as follows: 1) postoperative IOP greater than 20 mmHg or higher than the desired level in some

individuals who needed a lower IOP level, especially in cases of advanced glaucoma 2) a flat conjunctival bleb as a result of inadequate aqueous drainage through the scleral flap with 3) deep anterior chamber without internal blockage by iris or vitreous strand when a gonioscopy was performed.

The technique of laser suture lysis was performed in the following steps: 1) application of 0.5% proparacaine hydrochloride topical anesthetic solution to the treated eye, 2) placement of the Hoskins lens against the conjunctiva overlying the scleral flap sutures with gentle pressure sufficient to blanch the conjunctival vessels, allowing a direct view of the scleral sutures, 3) use of an argon laser of 100 μ spot size, 0.1 second, 300-450 mW to cut a suture under the conjunctiva while avoiding burning or perforation by getting sharp focus and shooting through the avascular area. Usually one shot was needed to cut one suture. In cases where the tenon's capsule was thick or the conjunctiva was unusually vascular, and the sutures were obscured, two to five shots were needed to lyse a suture. We observed a reduction of IOP, extent of bleb elevation, and anterior chamber shallowing immediately after treatment. A Hoskins lens was usually used to indent the central cornea to assist aqueous drainage through the filtration.

Results

Pre-laser IOP was 25.68 mmHg ± 7.24 mmHg, whereas the IOP after suture lysis was 9.68 mm Hg(Table 2). The difference was statistically significant ($p<0.0005$). The reduction of IOP was marked when compared to the preoperative IOP of 26.05 mmHg. This also had statistical significance ($p<0.0005$). After following these eyes for a mean of 10.32 weeks, the IOP remained controlled at 12.23 mmHg. Laser suture lysis was performed on a mean of 6.68 postoperative days, ranging from 1 to as long as 34 days.

There were 3 cases of temporary hypotony post laser suture lysis. All three eyes resolved spontaneously within the following week and regained satisfactory levels of IOP. We experienced no conjunctival damage[7] or flat anterior chambers.[7,8]

Discussion

Trabeculectomy, a partial thickness filtration surgery, is currently the most widely used surgical treatment for glaucoma. The procedure is associated with fewer complications than full-thickness operations which often produce over-drainage and related complications such as flattening of

Table 2. Intraocular pressure preoperative, before and after laser suture lysis in 22 eyes.

Intraocular pressure(mmHg)	Mean ± SD	Range
Preoperative	26.05 ± 10.56	12-48
Before laser	25.68 ± 7.24	16-40
After laser	9.68 ± 6.38	0-29
Last visit	12.23 ± 5.12	1-21

the anterior chamber, prolonged hypotony, corneal decompensation, peripheral anterior synechiae, and cataract formation.[2,3] However postoperative IOP control was not as good as in the full thickness procedure in both the short and long term periods.[4] Most cases have to resume anti-glaucoma medication or be re-operated.

To enhance the effectiveness of IOP reduction in trabeculectomy, many postoperative procedures have been advocated. These include digital massage, releasable sutures, and laser suture lysis. Lieberman first reported in 1983 the success of laser suture lysis. Lieberman first reported in 1983 the success of laser suture lysis on 20 patients.[5] He described using four mirror Goldmann goniolens and an argon laser of 100 μ spot size, 400-600 mW at 0.2 second duration to achieve lysis of the suture. In 1988, Savage and associates reported using laser suture lysis in 38 eyes of 43 patients and found the procedure was most effective in reduction of IOP if performed within the first 2 weeks. They demonstrated poor response if the laser suture lysis was performed at the third or fourth week postoperatively. They also reported complications such as hypotony with flat anterior chamber (28%), conjunctival damage with aqueous leaks (12%), and progressive significant cataract formation (8%). Both reports by Lieberman and Savage did not stress on tight scleral flap closure technique. Regarding the effective duration term for laser suture lysis, we were able to successfully perform the procedure on the 34 th postoperative day we consider this to be a relatively longer time than previous reports. By observation we found that in cases where mitomycin C was employed intraoperatively, a longer time window for effective laser suture lysis procedure occurred.

In 1990 Melamed and associates[8] reported a study of 22 eyes with uncontrolled glaucoma which underwent tight scleral flap trabeculectomy and postoperative laser suture lysis. They demonstrated a marked reduction of IOP from a mean of 29.3 mm Hg to 6.6 mmHg after laser suture lysis. Complications were much less than in previous studies, except one eye had excessive shallowing of the anterior chamber with forward dislocation of the intraocular lens and lens-corneal contact. We experienced no such complications in our study. It should be noted that we used a limbal-based conjunctival flap which was different from that used by Melamed et al.

Argon lasers are commonly used and available to most ophthalmologists for multiple applications in treating diseases in ophthalmology. Laser suture lysis after trabeculectomy is a relatively new application and is not yet very popular among ophthalmologists. We found that when combining tight scleral flap closure together with the laser technique we described, a controllable and predictable postoperative IOP level could regularly be achieved without serious complications. The technique of laser suture lysis can be performed by using the Zeiss four-mirror lens which is already available to most ophthalmologists or a simple glass pipette.[10] In cases of subconjunctival hemorrhage, a krypton red laser would be a better alternative as it has greater penetration and is less absorbed by the blood or hyperemic conjunctival tissue[11]

In conclusion, our results suggest that tight scleral flap trabeculectomy with subsequent laser suture lysis is a safe and efficient method for controlling intraocular pressure at relatively low levels while minimizing complications associated with over filtration. Laser suture lysis is another useful and available tool in the surgical treatment of glaucoma. We believe that tight scleral flap closure offers added protection against hypotony and further reduces complications associated with laser suture lysis. The technique should be widely used be surgeons to help achieve better surgical care for patients suffering from glaucoma.

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