

**Expanding
the Optometric Scope
of Glaucoma Management.**

**A Triple Procedure
Retrospective Study.**

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The passing of the *Optometric Glaucoma Legislation Bill #139* on November 13, 1997 authorized optometrists in the state of Michigan to treat glaucoma by means of topical medication. Suppose you are caring for a patient whose pressures cannot be controlled by topical medications alone. Do you know when to recommend a trabeculectomy, how to co-manage your patient's postoperative care, whether the trabeculectomy should be performed before, after, or in combination with cataract surgery and which patients and type of glaucoma have the most success with filtration surgery? Not only is it vital to master glaucoma treatment with topical and/or oral medicinal therapy, surgical intervention must be well understood to fully, and competently, treat our glaucoma patients.

The following report will define indications for combined cataract extraction, intraocular lens implantation and trabeculectomy (triple procedure) as well as factors influencing success, co-management, and complications while reviewing the results of our retrospective study.

ABSTRACT:

A retrospective study was done at the Detroit Veterans Administration Medical Clinic during the summer of 1997 comparing intraocular pressures of patients who had undergone triple procedures. In our study the triple procedures specifically involved uncomplicated superior incision extracapsular cataract extraction by phacoemulsification, posterior intraocular lens (I.O.L.) implantation and trabeculectomy.

SUBJECTS:

Postoperative triple procedures were studied on 18 glaucoma patients whom underwent the procedure between June 1995 and April 1997. Two groups, consisting of male and female, Black and Caucasian patients, were studied for a postoperative period of one year. The groups were divided according to incision dimensions. Group A consisted of 12 patients, with surgeries performed between June 1995 and May 1996, having incision dimensions of 4mm base width and 3mm in length. Group B, including 6 postoperative triple patients, had their surgeries performed between January and April 1997, with incision dimensions of 4mm base width and 1.5mm in length. Intraocular pressure, visual acuity, and number of medications were compared preoperatively and at one-week, one-month, six-months and if applicable, one-year postoperatively.

Triple procedures are performed on patients with reduced acuity secondary to cataract formation and intraocular pressures higher than acceptable patient specific target pressure by standard medicinal therapy. In general, medical therapy is insufficient if it cannot maintain the intraocular pressure within a range low enough to prevent further damage.⁷ The decision to perform filtration surgery must be based on the following factors. (1) the magnitude and duration of IOP elevation, (2) the extent and progression of visual field defects, (3) the extent of damage to the optic nerve head, (4) the patient's own sense of visual function, (5) the course of the contralateral eye with or without treatment, and, (6) the general health and age of the patient.⁷

Combined surgery could probably be performed more often not only for cataract patients with uncontrolled glaucoma, but also for patients who are non-compliant due to difficulty with the administration of these medications or if the medication is poorly tolerated⁵.

The more advanced the disease the lower the target pressure needs to be, which may be unachievable with the use of topical and/or oral medications alone. Including the trabeculectomy at the time of cataract surgery may possibly reduce or even alleviate the postoperative use of topical or oral treatment.

When the indications for cataract extraction are present but the glaucoma is well controlled medicinally, the conservative approach is to remove the cataract and continue the medical management of the glaucoma. Intraocular pressure is more easily controlled in some eyes after lens extraction, but a significant number of these patients will still require glaucoma surgery as early as three to six months after standard cataract extraction⁹. Therefore, successful results of triple procedures, with a report that over 90% of eyes do well in terms of postoperative control of intraocular pressure with minimal risk of complications, favor proceeding with combined surgery when either the cataract or the glaucoma or both require surgery⁹.

Furthermore, performing a trabeculectomy (the act of intraocular surgery in itself) on an eye without prior cataract or intraocular surgery may accelerate the formation of an already existing cataract or may lead to the formation of a cataract in a clear lens. In the reverse situation, subsequent cataract extraction in an eye with glaucoma and a good functioning bleb results in loss of the bleb in 30 to 50% of eyes and inability to restore

control of the glaucoma⁹. Therefore an eye with uncontrolled open angle glaucoma requiring glaucoma surgery and having a significant cataract (corrected vision of 20/40 or less) is an indication for combined surgery⁹ to alleviate loss of a prior filtration bleb.

There are, however, circumstances necessitating urgent filtration surgery should the cataract not be at a significant stage allowing combined surgery. The factors regarding urgent filtration surgery, in order of decreasing importance, are as follows: (1) rapid deterioration of function or of optic nerve appearance, (2) advanced stage of optic nerve damage (cup/disc ratio greater than 0.8 or area with absent rim), (3) advanced stage of visual field loss (significant deterioration within 10 degrees of fixation), (4) increase in IOP above a level known to cause optic nerve damage, and (5) increase in IOP to level considered likely to cause rapid worsening of the disc or field.⁷

It must also be kept in mind that in eyes with normal tension glaucoma, or that have already sustained severe damage to the optic nerve, visual dysfunction caused by glaucomatous changes may progress even after successful combined surgery¹¹, and is not necessarily an indication of failed surgery. Therefore, even successful surgeries may see a decline in visual function due to prior glaucomatous damage.

SUCCESS:

The success of filtering surgery in various glaucomas must be well understood in order to recommend a trabeculectomy. Table 1A has ranges for the various glaucomas according to Ritch, et al. Racial and age differences are considerations with Blacks often thought to

have a lower success rate than whites due to increased scarring characteristics. Older patients seem to have a higher success rate than younger patients⁸ due to the thinning of Tenon's capsule⁷ and decreased scarring capabilities with increased age. One study also noted other prognostic factors for filtration failure were diabetes mellitus, preoperative IOP greater than or equal to 20mmHg and two or greater preoperative medications¹³.

Table 1A: Success of filtering surgery in various glaucomas. (success varies markedly within categories)⁷

Good (>75%)	Fair (50%)	Poor (<25%)
Primary open-angle glaucoma	Aphakia	Neovascular
Chronic angle-closure glaucoma	Juvenile	Uveitic-active
Exfoliation syndrome	Iridocorneal endothelial syndrome	Congenital
Pigmentary glaucoma	Sturge-Weber syndrome	More than 2 previous filtration failures
Fuchs' heterochromia	Repeat filtration	
Angle recession	Anterior chamber IOL	
Posterior chamber IOL	Uveitic-inactive	

CO-MANAGEMENT:

Postoperative topical medications for combined surgery include an operative cycloplegic, a corticosteroid, and an antibiotic. The corticosteroid and antibiotic are each prescribed four times per day postoperatively. The corticosteroid is gradually tapered for one month and the antibiotic continued for one week. The initial follow-up visits are scheduled for 1-day, 1-week, 1-month, 3-months, 6-months and 1-year.

Complications of combined cataract and trabeculectomy surgeries include those of cataract surgery as well as a trabeculectomy procedure alone. These complications include, but are not limited to, inflammation, corneal edema, fibrin exudation, transient

intraocular pressure elevation, hypotony, detachment of Descemet's membrane, anterior uveitis, hyphema, induced astigmatism, wound leaks, iridolenticular/iridocapsular adhesions, peripheral anterior synechia, iris prolapse, iris capture I.O.L., decentration or tilting of the implant, diplopia, suture rupture, vitreous loss, cystoid macular edema and endophthalmitis.

Postoperative assessment of the patient includes the following parameters⁷:

- (1) bleb; extent and height, ischemia, limbal cysts, microcysts, and possible wound leaks,
- (2) anterior chamber; hyphema, hypopyon, and depth if shallow:
 - Grade 1 – peripheral iris touch;
 - grade 2 – iris touch up to the pupillary margin;
 - grade 3 – lens-cornea apposition,
- (3) cornea; clarity, epithelial erosion,
- (4) I.O.P.,
- (5) presence of choroidal detachment or suprachoroidal hemorrhage,
- (6) optic disc and macula appearance and
- (7) positioning of the intraocular implant.

It has been said that a filtering bleb is the cornerstone of IOP control in glaucoma⁷.

While the characteristics of the bleb produced are dependent upon the operative technique, postoperative medications, age of the patient and diagnosis, thick, succulent blebs are characteristic of partial-thickness filtration procedures, such as a trabeculectomy⁷. However, some patients do not develop an apparent bleb. It may be a

thinner, shallow bleb, as in elderly patients, possibly even low-lying or posterior. Early postoperative care is vital for ascertaining the adequacy and extent of the filtration bleb. Any critical modifications to the surgery, such as instilling Healon to reform a flat anterior chamber, or performing ocular massage to raise IOP, forcing more aqueous through the sclerostomy site breaking early adhesions and impeding outflow, are made in the first 2 postoperative days. Releasable sutures may also be used at the time of surgery allowing for postoperative reduction of incision tension, therefore increasing aqueous outflow through the bleb. Table 1B compares the height of the bleb to anterior chamber depth and intraoperative intraocular pressure and reveals possible situations to investigate should they occur.

Table 1b: Factor in judging intraoperative filtration.⁷

Bleb	Anterior Chamber	IOP	Problem
High	Deep	Adequate (10-25mmHg)	None
Flat	Transiently deep	Low (<5mmHg)	Wound Leak
Elevated	Transiently deep	Low (<5mmHg)	Excessive filtration
Flat	Deep	Elevated (>25mmHg)	Inadequate filtration
Flat	Shallow	Elevated (>25mmHg)	Aqueous misdirection, suprachoroidal hemorrhage, Choroidal effusion

TESTING PROCEDURES:

At each visit the following data was obtained for each patient; intraocular pressure via Goldmann applanation tonometry, Snellen visual acuity, and current number of medications. The preoperative measurements were compared with one-week, one-month, six-months and if applicable, one-year postoperative measurements.

DATA:

An average reduction in intraocular pressure of 3.5mm Hg and 12mm Hg were noted in group A at one year and group B at six-months respectively. An increase in visual acuity from the preoperative to the six-month postoperative visit for group A went from 20/70 to 20/50, and group B from 20/200 to 20/50. The number of medications used postoperatively decreased from two medications to only one in each group at six months postoperatively.

The clinical findings for intraocular pressure (I.O.P.) in each group are as follows:

The average intraocular pressure measurement went from 18.7mm Hg to 12, 12.08, 17, and 15.2 at the one-week, one-month, six-month and one-year postoperative visits respectively, with an overall mean reduction of 3.5mm Hg in Group A. (Table 2).

Table 2: Comparison of intraocular pressure for Group A.

Group A IOP	PREOP	ONE WEEK	ONE MONTH	SIX MONTHS	ONE YEAR
1	19	09	18	20	15
2	17	12	25	15	
3	17	02	07	28>24	
4	24	34>12	15	23>21	18
5	14	12>07	06	12	
6	17	28>07	11	16	16
7	30	12	10	19	11
8	17	07	18	18	
9	20	12	06	16	16
10	14	22>01	07	10	
11	18	10	12	18	
12	17	21>05	10	13	
Average	18.7	15.08>08	12.08	16.8	15.2
Median	17	12>08	12	17>17	16
> indicates the usage of ocular massage. #># denotes calculations before and after ocular massage					

The patients in Group B showed an average I.O.P. reduction of 12mm Hg.

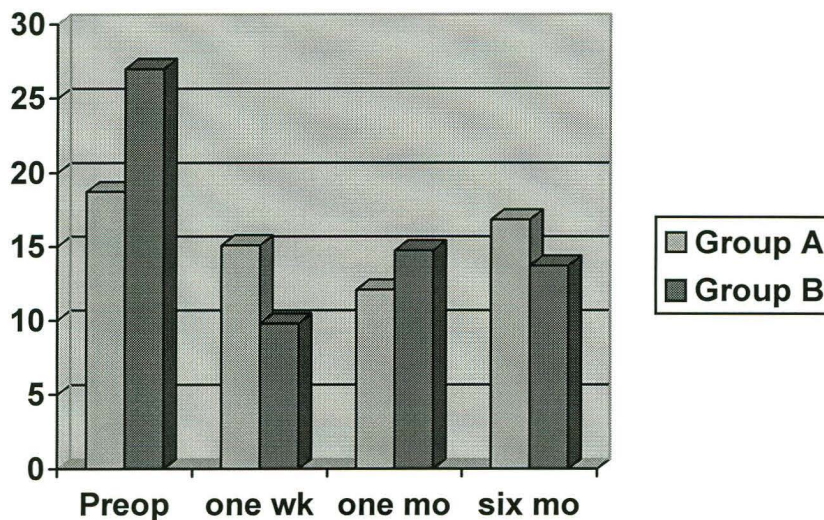
Preoperatively the average intraocular pressure was 27mm Hg decreasing to 9.8, 14.75, 13.7 and 15 at one-week, one-month, six-months and one-year postoperatively respectively. (Table 3).

Table 3: Comparison of intraocular pressure for Group B.

Group B IOP	PREOP	ONE WEEK	ONE MONTH	SIX MONTHS	ONE YEAR
1	16		18>15	14	15
2	43	10	08	08	
3	25	11	14		
4	20	20>10	19>19	19	
5	30	08			
6	28	0			
Average	27	9.8>7.8	14.75>14	13.7	15
Median	26.5	10>10	16>14.5	14	15

> indicates the usage of ocular massage.
#># denotes calculations before and after ocular massage

Chart 1: Reduction in intraocular pressure comparing Group A & B.



The clinical findings for visual acuity (VA) in each group are as follows:

The mean VA of Group A (Table 4) was 20/70 preoperatively, as compared to 20/70, 20/70, 20/50 and 20/45 at one-week, one-month, six-months and one-year respectively, showing an overall improvement of acuity at one-year.

Table 4: Comparison of visual acuity for Group A.

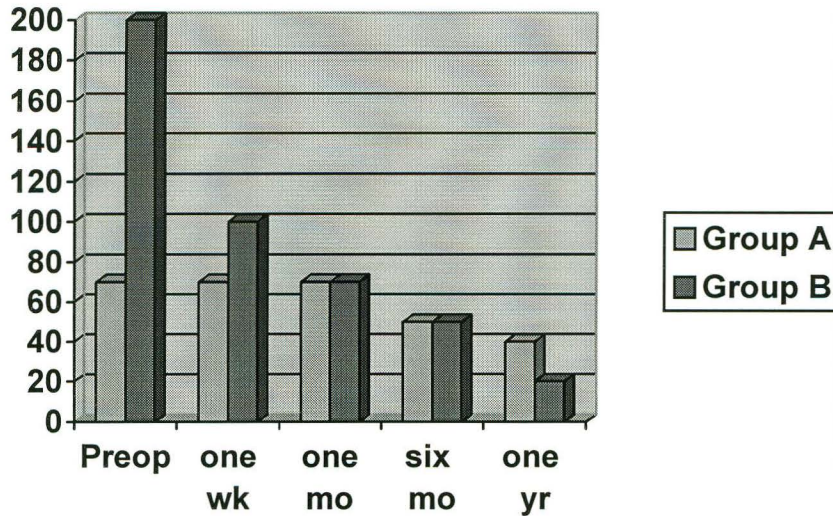
Group A VA	PREOP	1 WEEK	1 MONTH	6 MONTHS	1 YEAR
1	20/60	CF	CF	200	50
2	50	40	50	30	
3	60	80	400	30	
4	50	50	40	80	70
5	60	70	50	60	
6	25	40	40	25	40
7	80	60	50	25	30
8	80	200	100	30	
9	80	400	70	60	30
10	70	30	80	40	
11	60	200	80	60	
12	CF	70	70	50	
Average	20/70	20/70	20/70	20/50	20/40
Median	20/60	20/70	20/70	20/45	20/45

The average preoperative VA of Group B (Table 5) was 20/200, improving to 20/200, 20/200, 20/100, 20/70, and 20/50 preoperatively. Only one patient had reached their one-year postoperative visit prior to conclusion of the study. That patient presented with acuity of 20/20 at that visit, improving from finger counting preoperatively.

Table 5: Comparison of visual acuities for Group B.

Group B VA	PREOP	1 WEEK	1 MONTH	6 MONTHS	1 YEAR
1	CF		25	25	20
2	400	200	400	400	
3	LP	80	200		
4	60	70	40	30	
5	60	200			
6	200	400			
Average	20/200	20/100	20/70	20/50	20/20
Median	20/300	20/200	20/70	20/30	20/20

Chart 2: Comparison of visual acuity for Groups A & B.



The clinical findings for the number of medications in each group are as follows:

The average of 2 medications preoperatively in Group A decreased to .08, .08, 1.08 and 0.75 at one-week, one-month, six-months, and one-year respectively. (Table 6).

Table 6: Comparison of the number of medications for Group A.

Group A # of meds	PREOP	1 WEEK	1 MONTH	6 MONTHS	1 YEAR
1	0	0	0	4L,Tr,P6,DI	4
2	4N,O,P6,PR	0	0	2 O,N	
3	3 B,P2,PR	0	0	3 B,PR,P2	
4	2 B,P2	0	0	0	2 X,TR
5	1 O	0	0	1 O	
6	3 P4,N,TR	0	0	0	0
7	1 O	0	0	0	1 O
8	2 B,PR	0	0	0	
9	1 B	0	0	1 B	2 TR,B
10	2 O,P2	0	0	0	
11	1 B	0	0	1 I	
12	4PR,N,P6,B	1 P6	1 P6	1 N	
Average	2	.08	.08	1.08	.75
Median	2	0	0	1	2

L: Levocubastine, Tr: Trusopt, P: Pilocarpine followed by percentage, DI: Diamox, N: Neptazane, O: Optipranolol, B: Betagan, PR: Propranolol, X: Xalatan

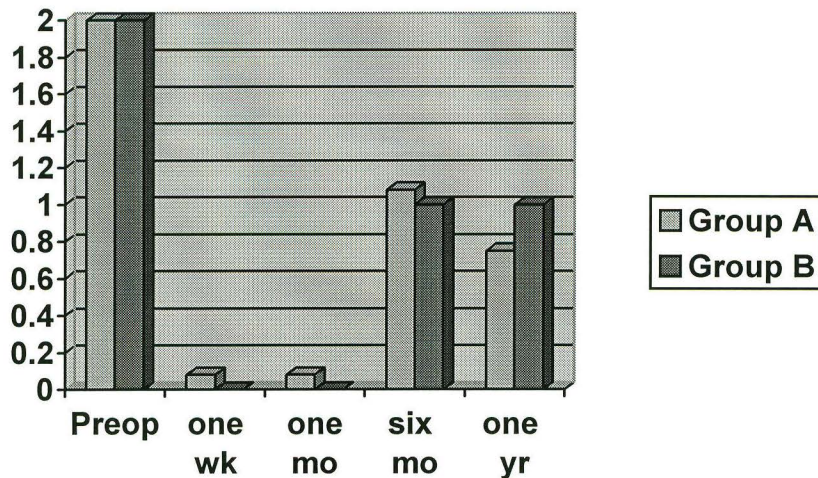
The average number of medications preoperatively of 2 in Group B were declined to 0, 0, 1, and 1 postoperatively at one-week, one-month, six-months and one-year. (Table 7).

Table 7: Comparison of number of medications for Group B.

97 # of meds	PREOP	1 WEEK	1 MONTH	6 MONTHS	1 YEAR
1	2 L,P4		0	1 L	1 L
2	Unknown	0	0	2 B,TR	
3	2 L,P	0	0		
4	3 TR,L,I	0	0	0	
5	2 TR,B	0			
6	2 TR,I	0			
Average #	2	0	0	1	1
Median	2	0	0	1	1

L: Levocubastine, Tr: Trusopt, P: Pilocarpine followed by percentage, DI: Diamox, N: Neptazane, O: Optipranolol, B: Betagan, PR: Propranolol, X: Xalatan

Chart 3: Alteration in number of medications in Groups A & B.



LIMITATIONS:

At the date of completion for this study, some patients had not yet reached their one-year postoperative visit, resulting in the inability of that data to be factored into the study. To help alleviate this problem when that circumstance arose, the six-month follow-up appointment was compared for each group rather than the one-year follow-up.

There is always debate regarding compliance with the use of glaucoma medications. If the compliance was poor prior to surgery, pressures may have been falsely higher than with proper preoperative usage of medications. The same can be said for the postoperative pressures regarding the use of topical and/or oral medication causing falsely high postoperative results.

As mentioned earlier, the progression of sustained glaucomatous damage may proceed even after intraocular pressure has been decreased through surgical means, making it difficult to attribute decreasing visual acuity to postoperatively occurring glaucomatous damage.

The limited number of triple procedures performed in 1997 prior to the initiation of our mid-year study produced a lower number of patients available for Group B.

DISCUSSION:

Literature reveals much controversy regarding the effect of cataract surgery on a prior trabeculectomy. While a 1984 publication, *Glaucoma Surgery*, states that the results of cataract surgery decrease the affectivity of a previous trabeculectomy, more recent studies have mixed reviews. Park, et al. concludes in their 1997 published research that “cataract surgery by temporal clear corneal phacoemulsification in eyes with filtering blebs after trabeculectomy does not adversely affect long-term IOP control”. Synder, et al. have a similar conclusion from their 1997 journal article. They state that “the technique of extracapsular cataract extraction with intraocular lens implantation is a safe

procedure giving good visual rehabilitation and having no influence on glaucoma control in patients who had previous glaucoma surgery”.

In contrast, Seah, et al. found that “eyes with previous successful trabeculectomies had higher IOP’s and required more medications after subsequent cataract surgeries.” This study also concluded that the interval between the cataract and trabeculectomy surgeries had no influence on IOP control. A 1997 article by Wynnanski-Jaffe, et al. came to the same conclusion claiming that “cataract extraction through corneal incisions in patients with functioning filtering blebs is followed by an increase in IOP. Cataract surgery in these patients does not neutralize the pressure-lowering effect achieved by the trabeculectomy, but it tends to elevate the post-trabeculectomy baseline pressure.” The postoperative IOP, however, was still significantly lower than the pretrabeculectomy IOP⁶.

The controversy surrounding the possible increase in intraocular pressure following cataract surgery on eyes with previous filtration surgery is yet another reason to have the knowledge and wisdom to offer simultaneous cataract and trabeculectomy procedures to our glaucomatous cataract patients. Remaining abreast of recent research and the latest clinical findings regarding this topic is crucial for proper care and management of our patients.

RESULTS:

The results of our study prove triple procedures to be effective in lowering intraocular pressure, improving visual acuity and reducing the number of medications postoperatively. Comparing Groups A and B suggests that trabeculectomy combined with cataract extraction and lens implantation may benefit with longer scleral flaps (3mm/Group A) rather than shorter flaps (1.5mm/Group B)¹⁷. There was no significant difference in the complication rate between the two groups.

CONCLUSION:

Understanding the indications for triple procedures as well as factors influencing success, co-management, and possible complications of post-trabeculectomy patients will expand our knowledge, scope of practice, and co-management capabilities and allow us, as competent optometric practitioners, to provide complete care to our glaucoma patients.

Bibliography

1. Park HJ. Kwon YH. Weitzman M. Caprioli J. "Temporal corneal phacoemulsification in patients with filtered glaucoma." *Archives of Ophthalmology*. 115(11):1375-80, 1997 Nov.
2. Synder A. Kowalski M. Omulecki W. Bogorodzki B. "Extracapsular cataract extraction with intraocular lens implantation after glaucoma surgery." *Klinika Oczna*. 99(1):25-8, 1997.
3. Seah SK. Jap A. Prata JA Jr. Baerveldt G. Lee PP. Heuer DK. Minckler DS. "Cataract surgery after trabeculectomy." *Ophthalmic Surgery and Lasers*. 27(7):587-94, 1996 July.
4. Yamagami S. Hamada N. Araie M. Shirato S. "Risk factors for unsatisfactory intraocular pressure control in combined trabeculectomy and cataract surgery." *Ophthalmic Surgery and Lasers*. 28(6):476-82, 1997 June.
5. Nielsen PJ. "Combined small-incision cataract surgery and trabeculectomy: a prospective study with 1 year of follow-up." *Ophthalmic Surgery and Lasers*. 28(1):21-9, 1997 January.
6. Wignanski-Jaffe T. Barak A. Melamed S. Glovinsky Y. "Intraocular pressure increments after cataract extraction in glaucomatous eyes with functioning filtering blebs." *Ophthalmic Surgery and Lasers*. 28(8):657-61, 1997 August.
7. Ritch, Robert. Shields, M. Bruce. Krupin, Theodore. "The Glaucomas." *The C.V. Mosby Company*. Volume 1, 654-681.
8. Sturmer, J. Broadway, DC. Hitchings, RA. "Young patient trabeculectomy. Assessment of risk factors for failure." *Ophthalmology*. 100(6):928-39, 1993 June.
9. Luntz, Maurice. "Glaucoma Surgery." *Waverly Press, Inc*. Chapter 9:91-105.
10. Chen, W. Lin, Z. Wang, N. Ge, J. Zhang, Z. Wei, Z. "Trabeculectomy combined with extracapsular cataract extraction and posterior chamber intraocular lens implantation." *Yen Ko Hsueh Pao. (Eye Science)*. 11(4):205-7, 1995 December.
11. Tanihara, H. Negi, A. Akimoto, M. Nagata, M. "Long-term surgical results of combined trabeculectomy ab externo and cataract extraction." *Ophthalmic Surgery*. 26(4):316-24, 1995 July-August.

12. Gimbel, HV. Meyer, D. "Small incision trabeculotomy combined with phacoemulsification and intraocular lens implantation." *Journal of Cataract & Refractive Surgery*. 19(1):92-6, 1993 January.
13. Shin, DH. Hughes, BA. Song, MS. Kim C. Yang, KY. Shah, MI. Juzych, MS. Obertynski, T. "Primary glaucoma triple procedure with or without adjunctive mitomycin. Prognostic factors for filtration failure." *Ophthalmology*. 103(11):1925-33, 1996 November.
14. Whitsett, JC. Stewart, RH. "A new technique for combined cataract/glaucoma procedures in patients on chronic miotics." *Ophthalmic Surgery*. 24(7):481-5, 1993 July.
15. Gimbel, HV. Meyer, D. "Small incision trabeculotomy combined with phacoemulsification and intraocular lens implantation." *Journal of Cataract & Refractive Surgery*. 19(1):92-6, 1993 January.
16. Saunders, W.B. "Dorland's Illustrated Medical Dictionary. Edition 28." W.B. Saunders Company.
17. Stock, CJ. Hughes, B.A. Horn, B. Morris, D.A. Shin, D.H. Juzych, M.S. *Long vs. Short Scleral Flaps in Combined Trabeculectomy and Cataract Surgery*.

Trabecula: a general term for a supporting or anchoring strand of connective tissue, as such a strand extending from a capsule into the substance of the enclosed organ.

Trabeculectomy: creation of a fistula between the anterior chamber of the eye and the subconjunctival space by surgical removal of a portion of the trabecular meshwork, performed to facilitate drainage of the aqueous humor in glaucoma.