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CME EDUCATION

Glaucoma and Ocular Hypertension: New Thinking

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"The old standard of achieving an IOP under 21 mm Hg is now extinct. You must go as low as you can safely."

— Alan L. Robin, M.D.

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What recent NEI trials tell us about treatment and therapy

by Alan L. Robin, M.D.

Strict, around-the-clock control of IOP is crucial in the treatment of susceptible ocular hypertensive and glaucoma patients. IOP lowering not only can prevent or retard the onset of glaucoma, but also can stop its progression, regardless of the type or stage of the disease.

The old standard of achieving an IOP less than 21 mm Hg is now extinct. You must go as low as you can safely. Just 1mm Hg can mean a corresponding reduction of 10% in visual field loss. Even early- to moderate-stage glaucoma has been shown to negatively impact patients' quality of life.

We should strive to treat these patients in a way that will reduce the progression of glaucoma, maintain the health related quality of life, and prevent blindness.

With this in mind, it is important to pick the right therapy the first time. Prostaglandin analogues have emerged as the newest standard in the medical management of open-angle glaucoma. These agents tend to induce compliance in patients that have minimal symptoms, and are an effective first line therapy for individuals with thicker corneas and that may not respond well to beta-blockers.

The studies

The NEI-sponsored multicentered glaucoma trials — the Ocular Hypertension Treatment Study (OHTS), Collaborative Initial Glaucoma Treatment Study (CIGTS), Early Manifest Glaucoma Treatment Study (EMGTS), and Advanced Glaucoma Intervention Study (AGIS) — were focused on the preservation of visual function.

Their goals for IOP reduction were modest compared with the reductions that prostaglandins can provide. OHTS and EMGTS, for example, called for only a 20% drop in pressure, while AGIS used an IOP endpoint of less than 18mm Hg. The CIGTS study was unique in that it was both visual field loss- and IOP-dependent. (figure 1)

Figure 1

Multi-Centered Studies

Study	Disease State	Therapies
OHTS	High IOP – NO Glaucoma	Meds *vs.* Observation
EMGT	Early Glaucoma	Meds & ALT *vs.* Observation
CIGTS	Non-Advanced Glaucoma	Meds *vs.* Surgery
CNTGS	**Advanced** Progressive NTG	Rx *vs.* observe
AGIS	**Advanced** OAG	Laser vs. Surgery

Figure 2

Progression

AGIS >3 Step Change
- 55% progressed
- Among eyes with progression
  - 30% progress to end stage disease
  - 18 bilateral blindness
    - One third of these had minimal damage to begin with

CIGTS > 2 Steps
- 73% Progressed
- Among those with progression
- ½ to end stage disease

What happens if glaucoma is left untreated? A prevalence study involving more than 1,600 subjects in St. Lucia was conducted in 1986-87.[1] At the time, 364 subjects (8.8%) were diagnosed with glaucoma. Ten years later, the group was summoned and diagnosed again. Applying the AGIS standard of less than a three-step change, or the CIGTS standard of less than two steps, a majority of the subjects had progressed, with between one-third and one-half reaching end stage disease. (figure 2)

These findings were reinforced by a 1998 report from the Mayo Clinic that capped a 30-plus-year study of glaucoma patients in Olmstead County, Minn.[2]

Citations:

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Twenty-two percent of the patients had developed bilateral blindness after 20 years of under-treatment. (figure 3)

Glaucoma is not pregnancy. It's not either you go blind or you don't. Elevated IOP can cause varying degrees of damage to the optic nerve.

In fact, there is almost a linear relationship between one's ability to operate a motor vehicle and visual field function.[3] Many individuals report a measurable impact from glaucoma on their quality of life, including mental health, color and peripheral vision, dependency, and social function.

In the early stages of glaucoma, ophthalmologists should perform visual fields in ocular hypertensives as well as stereoscopically evaluate patients' optic nerves. In the OHTS study, up to 41% of subjects converted to glaucoma through visual fields examinations before they converted through discs. (figure 4)

If we look at all the NEI multicentered trials, we find that lowering IOP statistically decreases the development of glaucoma. Specifically, from CIGTS, we know that tight IOP control minimizes the progression of glaucoma. And from AGIS, we find that early and consistent IOP control prevents the development of progressive visual field loss. Optic nerve preservation was obtained with even minor lowering of IOP.

Can the studies tell us which therapy to use?

The OHTS study found that subjects with thicker corneas responded less well to beta-blockers. With these patients, you may want to choose a prostaglandin as your first-line therapy. Also, we see from AGIS that different racial groups respond differently to different therapies. (figure 5)

With OHTS, the primary risk factors for the development of glaucoma were old age, thinner corneas, advanced visual field loss, and larger cup to disc ratios. Also, those with greater visual field loss to begin with tended to go on to develop blindness.

Therefore, we should be more aggressive in preventing visual field loss in these patients. Pay particular attention to their fellow eyes. If you have a patient who has severe damage in one eye and moderate damage in the other, be extremely aggressive your attempts to prevent blindness in the better eye.

The patient's family history and the age of the onset of glaucoma compared to their life expectancy should also be prime considerations. All of this means more yearly visits and possibly more medication changes to reduce the threat of vision loss. Again, early treatment is key, and prostaglandin analogues are more likely to succeed the first time.

Most importantly, weigh your risk factors. Think about each patient individually. This is important because you want to prevent your patients from going blind.

Figure 3

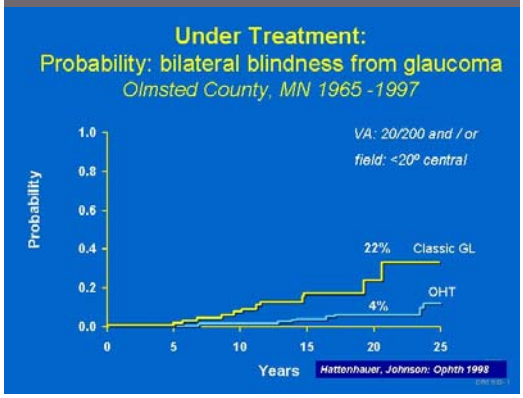


Figure 4

OHTS Endpoints

	Medications		Observation	
Visual Field	15	**41.7%**	29	**32.6%**
Optic Nerve	18	**50%**	51	**57.3%**
Both	3	**8.3%**	9	**10.1%**
Total	36	**100%**	89	**100%**

Figure 5

Ocular Hypotensive Response To Beta-Blockers

CCT Quartile	Baseline IOP	IOP Reduction
≤545.9	26.6 ± 3.1	-6.7 ± 3.6
545.9 – 568.4	26.0 ± 2.7	-6.3 ± 3.1
568.4-597.6	26. 1 ± 2.7	-6.3 ± 3.1
≥597.6	25.8 ± 2.	-5.3 ± 3.3

Comparative prostaglandin trials

by Quang H. Nguyen, M.D.

> "The take-home message is to look at the methodology of new studies carefully and compare findings with those of previously published studies."
>
> — Quang H. Nguyen, M.D.

The introduction of IOP-lowering prostaglandins was a significant breakthrough in the field of glaucoma.

In the early development, the parent prostaglandin, F-2 Alpha, showed IOP-lowering effect but was not well tolerated. After 10 years of development, an analogue molecule was developed in a way to preserve the drug's efficacy, while at the same time making it more tolerable to the eye.

Latanoprost (Xalatan, Pfizer, New York, New York), which came out in 1996, featured some significant improvements. First, an isopropyl group was attached to give it a pro-drug structure. Once this molecule is on the cornea after instillation, the corneal esterase converts it into an active molecule. The pro-drug allows a lower concentration and minimizes side effects. The second strategy is to remove the double bond at the carbon 13-14. This makes the drug more tolerable, while maintaining its stability and efficacy. (Figure 1)

Travaprost (Travatan, Alcon, Fort Worth, Texas) and bimatoprost (Lumigan, Allergan, Irvine, Calif.) were introduced into the market in 2001. Travatan's chemical structure is similar to Xalatan's, with minor modifications, but essentially it is a pro-drug as well.

Lumigan was initially launched as a prostamide, not a pro-drug.

However, mounting evidence demonstrates that bimatoprost does, in fact, work in a similar fashion as latanoprost and travaprost, and does get broken down into free-acid form and binds to the FP receptor.

Head-to-head studies reveal no statistically significant differences between prostaglandins

In a randomized, double-masked, 30-day study , the IOP-lowering effects of once-daily bimatoprost 0.03% (n=21), latanoprost (n=22), and vehicle control (n=21) were compared in patients with POAG or OHT.[1] The primary end point was reduction of IOP from baseline on days 14 and 29. Mean baseline IOP values measured at 8 a.m. were comparable among the groups, following appropriate washout of previous IOP-lowering medications.

Both Lumigan and Xalatan significantly decreased IOP from baseline after 14 and 29 days of treatment (P <.001). The difference between treatment groups was not statistically significant at either follow-up interval. (Figure 2)

In a similar three-month, multicenter, investigator-masked, parallel-group study,

Figure 1

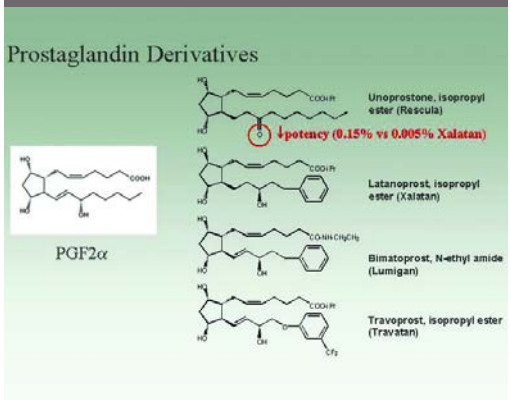
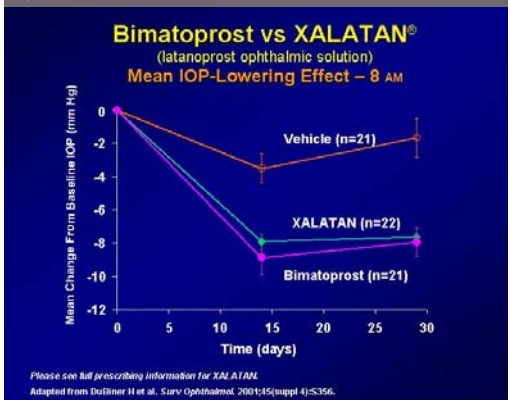


Figure 2



232 patients with OAG or OHT were randomized to receive bimatoprost 0.03% or latanoprost once daily in the evening.[2] IOP was measured at baseline, week one, and at months one, two, and three.

IOP measured at 8 a.m. was significantly reduced from baseline at every interval. The study found no statistically significant differences in mean IOP measured at 8 a.m. between treatment groups at week one, month two, or month three. IOP was also measured at noon, 4 p.m. and 8 p.m. at baseline and month three.

Mean IOP values measured at noon and 4 p.m. were statistically significantly lower with bimatoprost at month three. Gandolfi took the trial one step further in assessing conjunctival hyperemia. The molecules appeared to cause more conjunctival hyperemia, even though the scale was very small.

Peter Netland conducted a 12-month head-to-head study comparing latanoprost and travaprost.[3] Pressure readings were taken at 8 a.m., 10 a.m. and 4 p.m. Again, the results showed no statistically significant difference in efficacy between the two drugs. (Figure 3)

Quang H. Nguyen, M.D., is Director of Glaucoma Service, Division of Ophthalmology, Scripps Clinic, La Jolla, Calif. Dr. Nguyen has no financial interest in the information presented.

Figure 3

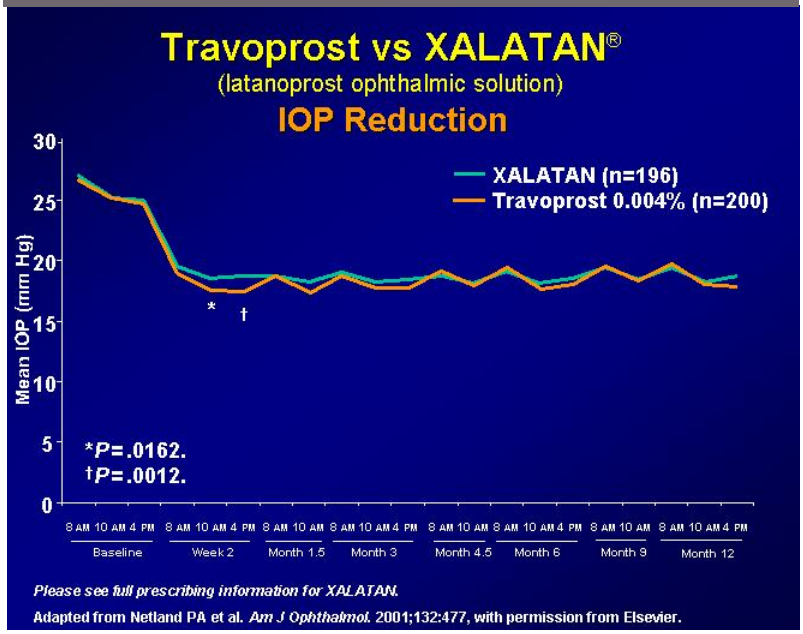
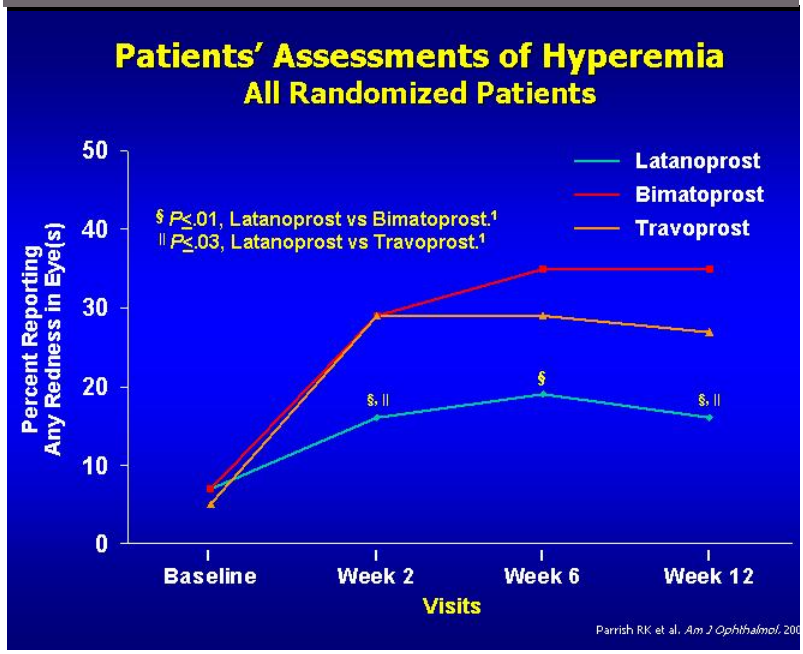


Figure 4



Different approach favors bimatoprost

A rigorously designed head-to-head efficacy study between Lumigan and Xalatan was conducted to meet standards for evidence-based clinical medicine.[4] Patients that had been prescribed bimatoprost or latanoprost previously were washed out for eight weeks.

Other medications were washed out for periods ranging from four days to four weeks. After washout, patients were assigned to one of two treatment groups: bimatoprost 0.03% or latanoprost 0.005% once daily in the evening for six months. Visits were scheduled at prestudy, baseline, week one, and months one, three, and six.

The primary endpoints were a mean change in baseline pressure at 8 a.m., noon, and 4 p.m. Secondary endpoints included specific target pressures and IOP reduction of 15% and 20%. In addition, the study also examined other safety parameters.

In this particular study, Lumigan showed better efficacy at every time point ($P \leq .025$) and better pressure reduction at month six at three time points (8 a.m., noon, and 4 p.m.). Baseline mean IOPs were almost identical between the treatment groups at 8 a.m. and 4 p.m.

At noon, the baseline IOP for bimatoprost was statistically significantly higher than for latanoprost ($P=.028$). At month six, the mean reduction from baseline IOP with bimatoprost at 8 a.m. was 1.53 mm Hg more than with latanoprost ($P<.001$).

Mean reduction from baseline IOP with bimatoprost at noon was 2.15 mm Hg more than with latanoprost ($P<.001$). Mean reduction from baseline IOP with bimatoprost at 4 p.m. was 1.18 mm Hg more than with latanoprost ($P = .004$).

Three-product study shows Xalatan is equally effective, produces less ocular irritation

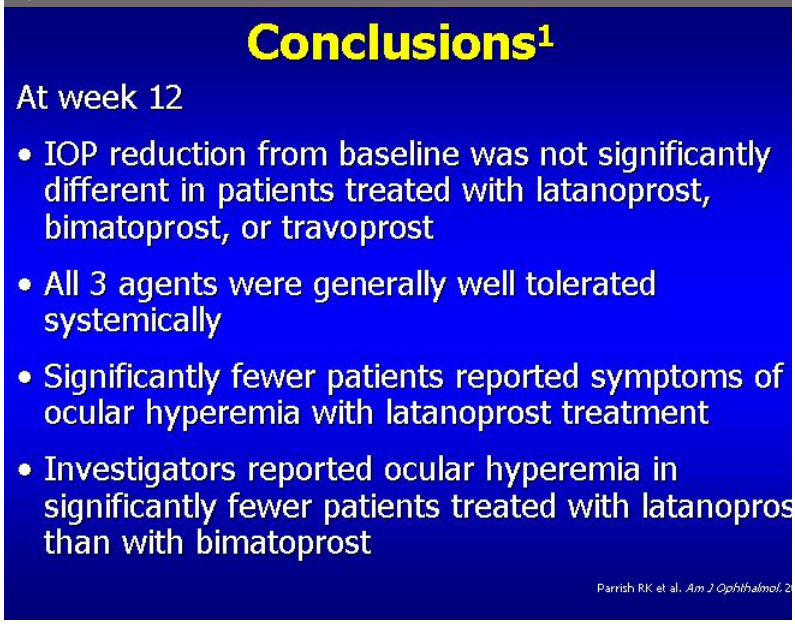
In 2003, the first head-to-head-to-head study involving Lumigan, Xalatan and Travatan was conducted in patients with elevated IOP over a 12-week period.[5] The primary end point of the study was the mean change in pressure from baseline at week 12 measured at the time of peak drug effect. Again, the 8 a.m. time point was chosen, as it approximates the time of maximal IOP reduction by the three drugs.

The secondary objective included ocular and systemic adverse events, as well as findings of visual acuity, lid and slit lamp examinations, ophthalmoscopy, and a grading scale to assess conjunctival hyperemia. The Parrish study shows equivalent efficacy among the three prostaglandins. Furthermore, the mean change in IOP from baseline for Xalatan is consistent with numerous previously published studies, except for Noecker.

The Parrish study also went a step further to assess conjunctival hyperemia by the investigator as well as the patients. Fewer latanoprost-treated patients reported an ocular adverse event compared with those receiving bimatoprost ($P<.001$).

The most frequently reported events were hyperemia and eye irritation. In all, 68.6% of bimatoprost patients reported ocular hyperemia as a side effect, versus 58% of travoprost patients and only 47.1% of latanoprost patients. This is significant because at the end of the day, the patient gives the most important response. (Figure 4)

Figure 5



The masked investigators' assessments of hyperemia were not statistically significantly different across treatments at baseline (P=.827). However, at weeks two and 12, average hyperemia scores were lower for latanoprost-treated patients than for bimatoprost-treated patients (P=.001 for both visits). Hyperemia consistently was rated lowest in latanoprost-treated patients and highest in bimatoprost-treated patients, with those in the travoprost group receiving intermediate average ratings. Throughout the 12 weeks of treatment, the degree of hyperemia associated with each medication remained consistent.

The conclusion from this study was that IOP reduction from baseline was not significantly different in patients treated with latanoprost, bimatoprost or travoprost. All three agents were generally well tolerated systemically. Significantly fewer patients reported symptoms of ocular hyperemia with latanoprost treatment. Investigators reported ocular hyperemia in significantly fewer patients treated with latanoprost than with bimatoprost. (Figure 5)

A few caveats about the different studies

Comparing the Noecker and Parrish studies side-by-side reveals important differences in design and methodology.

The Parrish study compared the IOP-lowering efficacy of latanoprost versus bimatoprost versus travoprost over 12 weeks. The study was single-masked and conducted at 45 clinics in the United States. The planned enrollment was 375 patients, and final enrollment was 411 patients — about a 10% increase. This 10% over-recruitment is standard in any multicenter trial study due to the fact that a patient may be lost to or otherwise unavailable for follow up. Mean baseline IOP levels at 8 a.m., noon, 4 p.m., and 8 p.m. were not significantly different across therapies.

Noecker compared the IOP-lowering efficacy of latanoprost versus bimatoprost over a period of six months. The study was single-masked and conducted at 18 clinics in the United States. The planned enrollment was 192 patients, and the final enrollment was 269 patients - about 40% over-recruitment. Mean baseline IOP levels at 8 a.m. and 4 p.m. were not different between the two prostaglandins. However, mean baseline IOP levels at noon were significantly different between the two groups.

There are a few other notable differences between the Parrish and Noecker studies. In the Parrish publication, the results are given in absolute numbers in a chart format, whereas the results of the Noecker study were presented as a bar graph. Also, the Parrish study lists standard deviations and attempts to exclude bias as well as present its weaknesses. The Noecker study did not discuss their weaknesses.

The take-home message is to look at the methodology of new studies carefully and compare findings with those of previously published studies.

Citations:

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ALT vs. SLT: What's new in laser therapy

by Ike K. Ahmed, M.D.

> "With SLT, there is increased safety and less tissue damage, particularly when you consider the likelihood that these patients may require future surgery down the road."
>
> — Ike K. Ahmed, M.D.

Laser trabeculoplasty was introduced in the early 1970s, initially thought of as a method of puncturing holes through the trabecular meshwork to lower IOP in glaucoma patients.

With the evolution of argon laser trabeculoplasty (ALT), the mechanisms are at once mechanical (producing contraction of the individual burns in the meshwork), biological (in effect replenishing the trabecular cells), and chemical (resulting in the release of cytokine). These mechanisms work together to improve the outflow of aqueous from the eye.

ALT was widely used in the late 1980s and early 1990s. However, over the last decade, the popularity of the procedure has waned due to its limitations.

These include long-term attrition, a general lack of repeatability (it can really only be applied once, with a secondary enhancement), post-operative IOP spikes, and the potential for coagulative damage to the meshwork. There are also some concerns about the effect of ALT on the success of future filtering surgery.

A 2003 study published in *Graefes Archives of Clinical and Experimental Ophthalmology*[1] found that there was an increase in the production of transforming growth factor-beta 2 concentration and bleb scarring in patients that had undergone ALT.

Enter selective laser trabeculoplasty (SLT).

SLT is a safer alternative to ALT because it provides a target within the meshwork. Pigmented melanin cells can be selectively burned without significant damage to adjacent, non-pigmented cells. The result is the desired biological and chemical effect of LT with only minimal collateral damage.

SLT is applied using a Q-switched, frequency doubled YAG laser that produces very short pulses of energy — about 3 ns, compared to ALT's continuous wave laser. This is significant, allowing for selective photothermolysis, whereby the heat generated by the short pulses is confined to the pigmented melanin cells.

A comparison of the specifications of the ALT and SLT laser treatments reveals some important differences. Both are applied over about 50 spots at 180 degrees, but SLT's larger beam diameter reduces the need for fine focusing, angle appearance, and angle visibility.

Figure 1

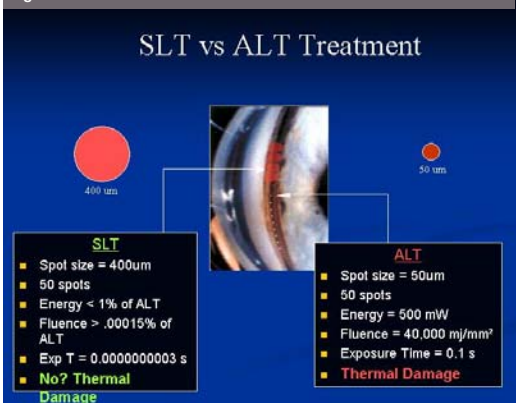
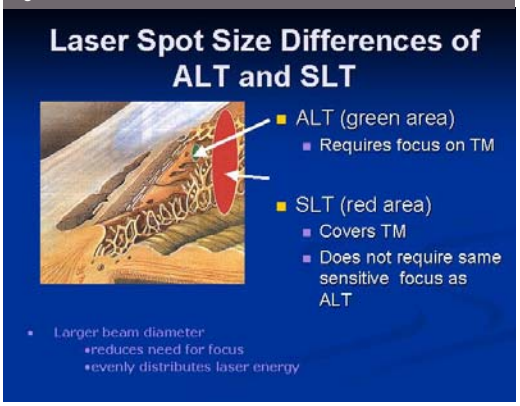


Figure 2



ALT must be applied over a much smaller area and, therefore, is not easy to apply consistently. Moreover, the energy levels with SLT are less than 1% of those with ALT-induced burns. The fluence and exposure time of SLT are also significantly less. All of this translates into minimum, if any, damage to the trabecular meshwork with SLT. (figures 1 and 2)

The studies

An *in vitro* study led by Mark Latina, M.D.,[2] looked at thermal transfer, indicated in red, of ALT versus SLT lasers. ALT showed high thermal absorption across the entire surface area, while only the pigmented melanin cells were affected with SLT. (figure 3)

Another head-to-head study [3] induced cellular response in human cadaveric eyes with SLT and ALT.

SLT was shown to cause a gentle response of the autoimmune system to begin cleaning the trabecular meshwork, without the coagulative damage of ALT.

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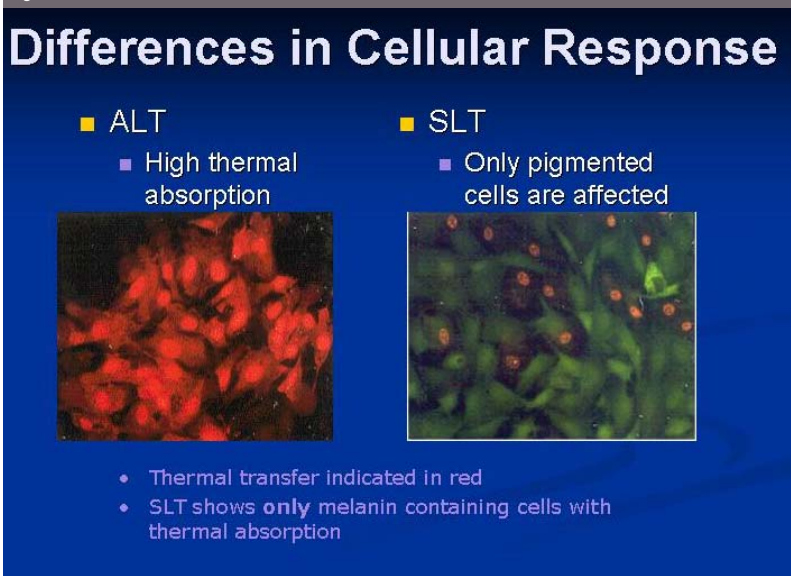
Figure 3



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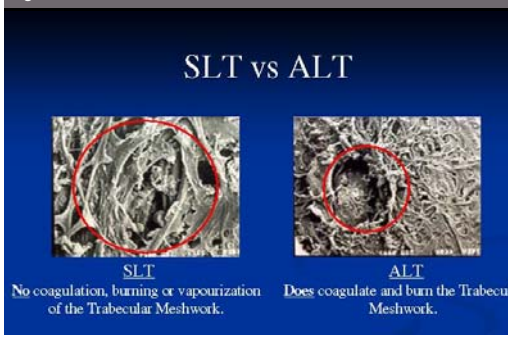
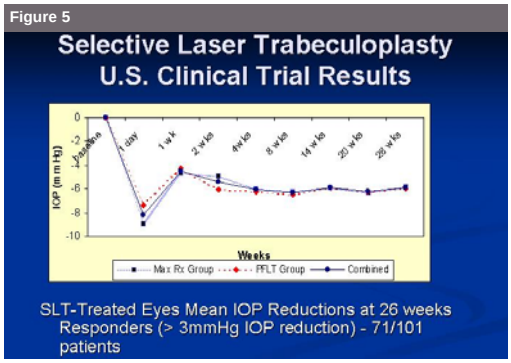


Figure 5



Further, if one compares the SLT-treated eyes to control eyes, there is little visible difference between the two. One can achieve the desired result, not necessarily by stretching the contraction, but by creating more of a biological or chemical cytokinetic pathway. (figure 4)

U.S. clinical trial results of SLT lasers, again headed up by Latina,[4] looked at efficacy among three groups: A maximum medical therapy group, a group that had previously failed laser trabeculoplasty, and a combined group. The results showed mean IOP reductions of greater than 3 mm Hg at 26 weeks out among all three groups. These findings may open the door for SLT treatment of those that had previously failed LT. (figure 5)

A study out of Ottawa, Canada[5] presents longer-term data looking at SLT versus ALT for uncontrolled patients on medical therapy. The study found no meaningful differences in IOP lowering from baseline to three years. Interestingly, it did find that those that had previous ALT treatments experienced a greater drop in pressure in the SLT-treated eyes than in the ALT eyes. (figure 6)

The efficacy of SLT as a primary therapy is currently being studied. The GLT trial,[6] published in 1995, compared ALT to topical medical therapy in a stepped regimen using 271 untreated COAG patients.

Two years out, there was lower IOP control with ALT. After seven years, again there was lower IOP with ALT, with better visual field and optic nerve endpoints. There were some design problems with this study — patients were on medical therapy in their fellow eye — but ALT was shown to be at least as efficacious as topical medical therapy. Notably, the majority of patients did require medications in the ALT group in the postoperative period.

A prospective, non-comparative trial by an Israeli group[7] involved 31 patients with 18-month follow-up. The researchers found a mean IOP reduction of 30%. Eleven percent of patients had an IOP spike greater than 5 mm Hg within one hour, and there were no serious complications with the SLT treatment.

A similar new study, to be conducted at 15 centers in the United States and one in Canada, will look at SLT treatment versus stepped medical treatment as initial therapy in a large group of glaucoma patients (n=340). The initial recruitment has begun for what is intended as an 18-month trial. It will also look at cost, compliance, and quality-of-life considerations.

With repeatability, we're talking about the ability to perform laser therapy on a specific area of the eye. ALT produces generally poor results in repeatability, in large part because there is a higher risk of complication from the treatment.

Because of the less tissue trauma, SLT is theoretically an argument for repeatability. Although there are no clear-cut studies to demonstrate this, Latina and Damji have shown that SLT appears to be effective in patients who have previously failed ALT.

Do pre-treatment medications affect the end outcome of SLT?

In a recent poster that was presented at AGS 2004, Latina showed that those patients that were on prostaglandin analogues had less of a response with SLT treatment. Perhaps this is related to matrix metalloproteinase (MMP) enhancement. Both prostaglandin analogues and SLT work by this mechanism in the meshwork.

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Figure 6

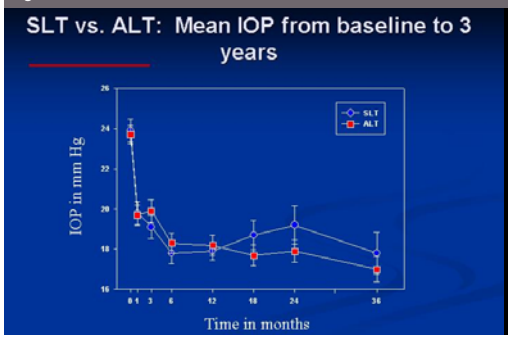


Figure 7

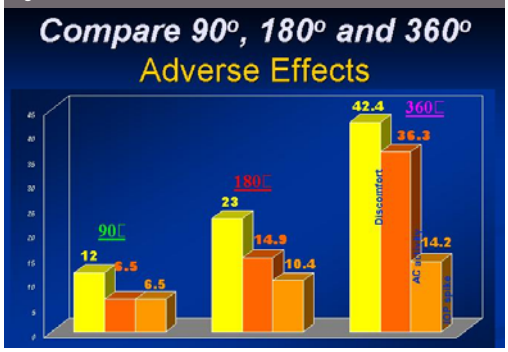
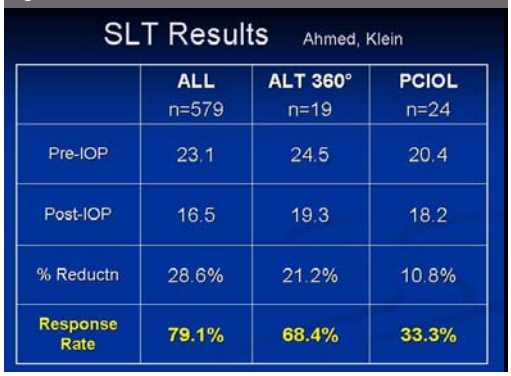


Figure 8



SLT Results Ahmed, Klein

	ALL n=579	ALT 360° n=19	PCIOL n=24
Pre-IOP	23.1	24.5	20.4
Post-IOP	16.5	19.3	18.2
% Reductn	28.6%	21.2%	10.8%
Response Rate	79.1%	68.4%	33.3%

With regard to phacoemulsification, studies have shown that ALT treatment does better in phakic than in pseudophakic eyes.[8] Beyond that, there is only speculation among surgeons that those patients that may be looking at combined procedures consider laser trabeculoplasty pre-operatively, and then we can assess whether or not to go with phaco.

There have been other studies that have looked at differences in the angle used in SLT. A U.K. study by Nagar (IGS 2003) showed a slightly more effective response with 360-degree treatment as opposed to the 180- or 90-degree treatment. However, the 360-degree treatment did result in more complications.

There are others that argue that the effect between 90 and 180 degrees is fairly similar, that the mechanism is, indeed, some sort of cytokinetic or biochemical effect, and perhaps we only need to treat a small part of the meshwork. (figure 7)

In Toronto, we looked at a series of 579 patients and found that there was an effect of ALT treated eyes (publication in process). In fact, the response rate was 68.4% compared to only one-third of the patients that had posterior chamber IOL.

So, again, there does appear to be a difference with pseudophakic eyes. Specifically, we found that higher pre-op IOPs tended to respond better than the normal-tension glaucoma patients.

As expected, those that had primary therapy and those that were older responded better. Negative predictors included greater pre-operative medications, posterior chamber IOLs, and prior laser trabeculoplasty in younger patients. Angle, pigmentation, race, and iris color were negligible in terms of the effects. (figure 8)

We will likely see more of these types of targeted lasers coming out - lasers that are less costly and help with compliance issues. The efficacy of ALT and SLT seems to be fairly similar over five years of data. But with SLT there is increased safety and less tissue damage, particularly when you consider the likelihood that these patients may require future surgery down the road.

Practical approach to combined procedures

by Alan S. Crandall, M.D.

"I believe the anatomy of the cornea favors a temporal incision, particularly a cataract incision."

— Alan S. Crandall, M.D.

Is there a role for combined procedures in modern cataract and glaucoma management? The short answer is yes. Evidence-based data supports the use of these same-day techniques. Specifically, I believe the safety and increased ease of temporal cataract extraction outweigh any slight disadvantages.

The indications for performing combined surgery include the presence of glaucoma and cataract, cataract in an eye with a compromised optic nerve, and cataract in an eye with a failed trabeculectomy.

Weighing the pros and cons

Filtration surgery followed by cataract at a later date has long been the gold standard. Many physicians feel that the success rate is higher with separate procedures, although the modern literature seems to dispute that claim. Perhaps the biggest advantage of using this particular method is that the pupil will often enlarge, making the cataract procedure easier to perform.

But following up filtration surgery with cataract surgery has inherent disadvantages as well. The first is obvious: It is two procedures. From the patient's standpoint, that means an additional expense and a significant delay in visual rehabilitation.

From a surgical standpoint, trabeculectomy has been known to induce rapid advancement of the cataract, or at least the onset of a cataract. And, of course, cataract surgery may cause bleb failure, particularly if you use conjunctival incisions.

Cataract surgery alone may reduce IOP by 3 mm Hg to 4 mm Hg, especially when a successful phaco with an IOL in the bag has been implanted. However, it is important to remember that 30% of controlled glaucoma patients will experience a pressure spike of greater than 15 mm Hg on the day of surgery.

To minimize the risks, I try to schedule patients early in the day so that I can measure their pressures about six to eight hours following the cataract extraction.

The most commonly used procedure is phaco trabeculectomy, with or without antimetabolites. You can do one side or you can do two sides, and multiple studies over time have shown the results to be excellent.[1]

There is a little tissue disturbed so that if you have a need for future surgery there is still plenty of space available.

Keep in mind, however, that this procedure is technically more difficult. Also, dealing with pupil abnormalities, particularly pseudoexfoliation, can be challenging, though there are now at least eight or nine different modalities available to handle these sorts of aberrations. Phaco-trabeculectomy does not always yield equivalent results to separate procedures.

Figure 1

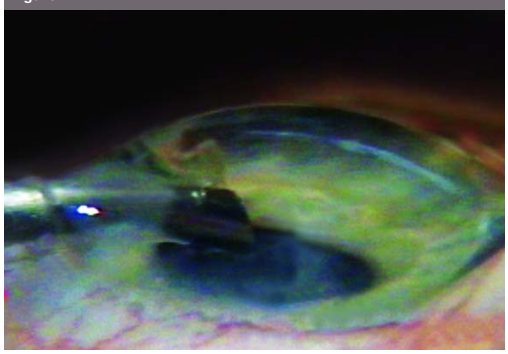
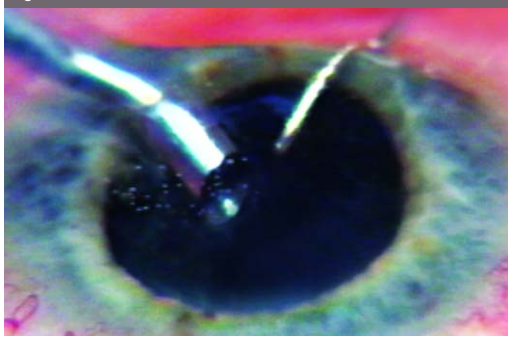


Figure 2



Another potential way of managing cataract and glaucoma is a superior trabeculectomy with a temporal clear cornea cataract. With this approach, there is less manipulation of the trabeculectomy site, which may yield better results. Temporal cataract phacoemulsification has been shown to decrease endothelial stress, which is important in glaucoma eyes.

Many of us have already moved toward the temporal approach because we find the cataract surgery is technically easier to perform. (Figures 1 and 2)

Unless you do clear corneal incisions, you're likely to disturb too much conjunctiva, reducing your chances of success. Studies have shown that if you look at all the parameters, such as giant cell with proliferation and posterior capsule opacification, all of the third-generation silicones are actually better than PMMA in glaucoma eyes.[2]

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Citations:

1 Wyse T, Meyer M, Ruderman, et al, Combined trabeculectomy and phacoemulsification: A one-site vs. a two-site approach. Am J Ophthalmol 1998, 125:334--339.
2 Park HJ, Weitzman M, Caprioli J, Temporal corneal phacoemulsification combined with superior trabeculectomy. Arch Ophthalmol 1997. 115:318--323.

Figure 3

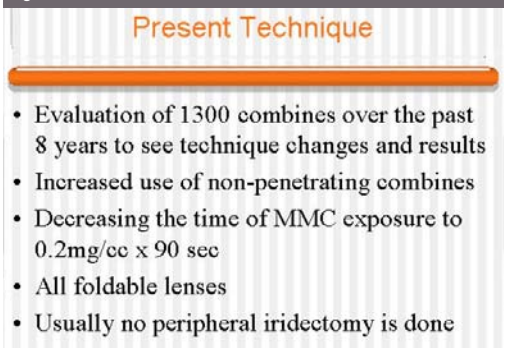
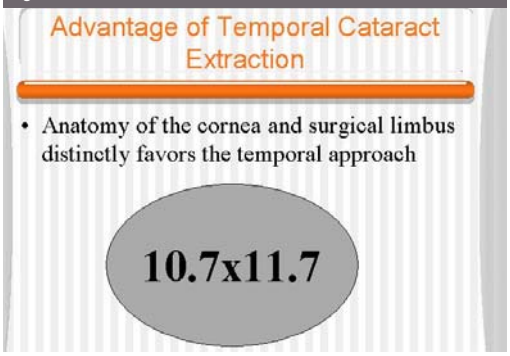


Figure 4



One additional modality that is becoming more common for same-day surgery is cataract extraction with endophotocoagulation of the ciliary processes. This procedure is billed as a simple cataract extraction with a simple laser procedure. But again, there are potential pitfalls.

If the technique is cyclo-destructive, it can lead to phthisis; conversely, if it is not cyclo-destructive, it may not be permanent. The data in this field is largely anecdotal.

Non-penetrating surgery combined with cataract surgery is a viable option. The advantage here is that there are likely to be fewer complications when compared to standard combines. Some European studies seem to confirm this. Another advantage is that there is more rapid visual recovery. Thirdly, you should experience a significant decrease in late complications of filtering procedures.

The downside of non-penetrating surgery combined with cataract surgery is that it requires a very steep learning curve just to do the procedure. It is also more time consuming. A regular combined procedure can be done in 20-25 minutes, but this procedure may take up to 45-50 minutes.

And in the end, they may not yield as low a pressure as you can get from mitomycin C combined trabeculectomy. There are currently no long-term results of studies available.

Recommended procedure

My present technique is a combined two-side procedure. I've done about 1,300 of these over the last eight years. I have decreased the amount of mitomycin exposure to 0.2 mg/cc for 90 seconds instead of the 0.4 for estimated three to five minutes that we used before. And, of course, I use all foldable lenses. I no longer do any peripheral iridectomies in combined procedures. (Figure 3)

I start superiorly and do the fornix-based peritomy, dissect the scleral flap, put on the mitomycin sponge, and rotate temporally. I insert a clear cornea/phaco/IOL and place a 10-0 suture but leave it untied. Later, I return superiorly to complete the glaucoma procedure.

Most evidence-based medicine now shows that the two procedures are equivalent in their pressure-lowering effect.[1,2]

Some may point to the time involved in rotating the machinery. I like to manipulate my instruments while the mitomycin is being placed on the eye, and I rotate the microscope and foot pedals during the 90 seconds while the sponge is on the eye.

Critics also may claim that by being limited to clear corneal incisions there is an increased incidence of endophthalmitis. But the data suggests that this is most often related to poor wounds.

With combined procedures, I always suture the temporal incision because of the risk for hypotony, and having bacteria enter the eye during a hypotonus state.

As for the use of foldable lenses, all recent generations of these lenses have been shown to be as bio-compatible as PMMA. Both acrylic and silicone lenses are excellent.

So, what's the point of moving temporally when one site is technically much easier? I believe the anatomy of the cornea favors a temporal incision, particularly a cataract incision. Moreover, there's more space temporally and less endothelial stress. (Figure 4)

There continues to be rapid evolution of these combined surgical techniques, which are an important part of the surgical armamentarium. Long-term goals of visual field stabilization and good acuity seem within our grasp.

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CME EDUCATION

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How was the CIGTS study different than OHTS, EMGTS, and AGIS studies?

- ❑ It focused on preservation of visual function.
- ❑ It focused on IOP reduction.
- ❑ It focused on both visual field loss and IOP reduction.
- ❑ It was not different from the other multicentered studies.

According to Dr. Robin, ophthalmologists should consider the following factors when developing a treatment plan: (1) the patient's family history, and (2) the age at glaucoma onset compared to patient's life expectancy.

- ❑ True
- ❑ False

Dr. Ahmed's series of 579 eyes noted no difference in the response rate of pseudophakic eyes to SLT.

- ❑ True
- ❑ False

A combined procedure would not be indicated in an eye with a cataract and a compromised optic nerve.

- ❑ True
- ❑ False

The available prostaglandins have been shown to be equally effective at reducing IOP.

- ❑ True
- ❑ False

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