Laser Trabeculoplasty
What You Must Know Before Having It Done

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Originally published as seven articles on New-Glaucoma-Treatments.com
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New Glaucoma Treatments is a GLAUCOMA HealthHub maintained by multi-awarded Glaucoma Eye Doctor in California, Dr. David Richardson. It’s primary purpose is to provide valuable information to glaucoma patients and their caregivers worldwide about the latest developments and treatments for glaucoma, while providing answers to commonly asked questions about glaucoma, care and treatment options. All articles are either written by Dr. David Richardson or by professional health topics writers (reviewed by Dr. David Richardson prior to publishing).
Introduction to Laser Trabeculoplasty

In most open angle glaucomas the aqueous fluid is unable to pass through the Trabecular Meshwork (drainage grate inside the eye) as easily as it should.[1] Partly due to this knowledge, most surgical treatments of glaucoma have focused on improving passage of fluid across this meshwork or simply bypassing the meshwork altogether.

Laser Trabeculoplasty. A Quick History.

Laser trabeculoplasty attempts to improve flow of fluid across the trabecular meshwork by focusing wavelengths of light onto the trabecular meshwork. The concept of using light energy to open up the trabecular meshwork dates back to 1961.[2] Lasers were not yet available for clinical research as they had only been invented the year prior to that. Rather, a xenon-arc photocoagulator was used on the trabecular meshwork of animals resulting in a reduction in intraocular pressure (IOP).

It was not until the early 1970s that lasers were used in an attempt to punch holes through the trabecular meshwork.[3] These microscopic holes, however, closed down with time. Ironically, in 1975 it was reported that application of

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1 Grant WM. Further studies on facility of flow through the trabecular meshwork. AMA Arch Ophthalmol. 1958;60(4 Part 1):523-33.
laser energy in an attempt to coagulate (or melt) the trabecular meshwork could be used to experimentally create glaucoma in monkeys.[4]

In a twist that is typical of scientific discovery, another set of scientists discovered that some of these monkeys ended up with long-term lowering of their IOP.\[5\] **By 1979 what we think of as Laser Trabeculoplasty (LT) was introduced in humans.**\[6\] Essentially, 50-100+ very short laser pulses are used to gently irradiate the trabecular meshwork. No holes are created, but for reasons that are not entirely understood, this allows fluid to more easily leave the eye.

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Types of Laser Trabeculoplasty

There are three types of lasers currently used for trabeculoplasty glaucoma surgery: Argon, “Selective”, and Micropulse.

Argon Laser Trabeculoplasty (ALT)

This type of laser has been around the longest. It is generally performed in one or two sessions. However, it can result in microscopic scars called “peripheral anterior synechiae”[7] that can limit the effectiveness of the treatment as well as future surgeries (such as canaloplasty).

Selective Laser Trabeculoplasty (SLT)

Selective Laser Trabeculoplasty (SLT) was first reported in 1995.[8] It uses a

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8 Latina MA, Park C. Selective targeting of trabecular meshwork cells: in vitro studies of pulsed and CW laser...
“Q-switched, frequency-doubled Nd:YAG laser”. This laser energy is preferentially absorbed by the pigment-containing cells in the trabecular meshwork while cells without pigment are left undamaged.\[9\] Because SLT does not “coagulate” (or melt) tissue this results in a less traumatic laser treatment compared to ALT.\[10\]

SLT appears to cause less damage to the eye tissue and uses less than 1% of the energy required for ALT.\[11\] It is rapidly becoming the preferred method of laser surgery (over ALT) for treating primary open angle glaucoma. It can also be performed on patients who have already had received a full treatment of ALT.\[12\]

**Micropulse Laser Trabeculoplasty (MLT)**

Micropulse Diode Laser Trabeculoplasty (MDLT or MLT) is the latest addition to the Laser Trabeculoplasty party. MLT works by using very short bursts of the laser (called “micro-pulses) to heat up the trabecular...
meshwork cells without destroying them. This avoids the damage and scarring associated with ALT while minimizing the inflammation and post-operative IOP elevations seen with both ALT and SLT.\textsuperscript{[13]}

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How Well Does Laser Trabeculoplasty Work?

How Well Does Laser Trabeculoplasty (LT) Work?

ALT vs. SLT vs. MLT for GLAUCOMA

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Argon Laser Trabeculoplasty (ALT)

Argon Laser Trabeculoplasty (ALT) successfully lowers the intraocular pressure (IOP) in just over 80% of the eyes that receive this treatment. IOP lowering may not be realized for up to a month after the treatment. On average the IOP is reduced by 6-9mmHg. Unfortunately, the effect does not last. After a few

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ars additional treatment is generally needed to lower the IOP.[16]

**Selective Laser Trabeculoplasty (SLT)**

Selective Laser Trabeculoplasty (SLT) success is dependent upon how much of the trabecular meshwork is treated. When only half of the trabecular meshwork is treated (180 degrees) SLT successfully lowers the intraocular pressure (IOP) 65% of the time with an average reduction in IOP of just over 4mmHg (range of 2 to 18mmHg).[17] However, when a full 360 degree treatment is applied the IOP can be expected to be reduced in almost all eyes by 11-40%.[18] In general SLT appears to work as well as ALT.[19]

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Micropulse Laser Trabeculoplasty (MLT)

Although this is relatively new technology, it does appear promising. Initial studies (though small) demonstrated reductions in IOP and need for medications that are similar to those seen with ALT.\textsuperscript{[20]} Larger studies are underway.

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Can Laser Trabeculoplasty Be Repeated?

That depends upon the type of laser used. Only one full (360 degree) or two partial (180 degree) treatments of **Argon Laser Trabeculoplasty (ALT)** can be performed on an eye. Once a portion of the trabecular meshwork has been treated with the Argon laser, additional treatments with ALT typically result in either minimal IOP lowering\(^{[21]}\) or a rapid decline in effect.\(^{[22]}\) Selective Laser Trabeculoplasty (SLT), however, can be effective after failed ALT.\(^{[23]}\)

**Selective Laser Trabeculoplasty (SLT)** may be repeated multiple times so long as there is an initial IOP-lowering response to the first treatment.\(^{[24]}\) When SLT is repeated after the first SLT treatment has worn off the IOP may be further reduced by about 20% in 43-67% of treated eyes.\(^{[25]}\) Eventually, however, re-

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treatments lose their effect at which time medical or non-laser surgical options must be considered if the IOP is too high.

There are currently no published studies looking at the effect of repeated Micropulse Laser Trabeculoplasty (MLT). It is believed that thermal damage is what limits the benefit of repeated treatments. At least in theory, as MLT does not result in thermal damage to the trabecular meshwork it should be repeatable.


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Laser Trabeculoplasty is usually painless (though not always), fast, and relatively safe. As such, it can be offered to almost anyone with open angle glaucoma at almost any stage in the disease.

Commonly Encountered Complications Associated with LT

As with all surgical procedures, however, there are risks associated with Laser Trabeculoplasty. Following are some of the more commonly encountered complications associated with LT.

Intraocular Pressure Elevation (Spike)

The main risk of all Laser Trabeculoplasty treatments (or any glaucoma laser treatment of the eye for that matter) is a spike in intraocular pressure (IOP). Clearly, when one’s goal is to lower the IOP this is undesirable. Fortunately, these elevations in IOP are generally short-lived. Rarely, however, the IOP will stay elevated which then requires
additional non-laser glaucoma surgery for control.[26]

Because of this risk of developing increased eye pressure after LT, many surgeons will treat only half of the trabecular meshwork at the first session. The remaining trabecular meshwork can then be treated, if necessary, at a later date. It is sometimes the case that treatment of only half of the trabecular meshwork is required to achieve IOP lowering.

**Scarring of the Eye’s Drainage System (Peripheral Anterior Synechiae)**

One notable risk of Argon Laser Trabeculoplasty (ALT) is scarring of the drainage angle and Schlemm’s (drainage) Canal. This scarring is called Peripheral Anterior Synechiae (PAS). It occurs in approximately 12-47% of eyes that have undergone ALT.[27]

Angle scarring had been considered a minor issue as it rarely caused problems other than decreasing the effect of the ALT. Today, however, there are multiple “Minimally Invasive Glaucoma Surgeries” (MIGS) that may not work as well when there is scarring of the angle structures. Fortunately, angle scarring is seen in less than 3% of eyes treated with Selective Laser Trabeculoplasty (SLT).[28]

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Because ALT may “close doors” on future MIGS options patients who would benefit from Laser Trabeculoplasty should generally opt for SLT or MLT where available. Of course, there are exceptions, but they are rare.

Rarely encountered additional risks of Laser Trabeculoplasty include corneal damage and swelling of the central retina (macula), both of which could result in loss of vision.

Who Should Consider Laser Trabeculoplasty?

Most anyone with open angle glaucoma that requires treatment is a candidate for Laser Trabeculoplasty. Although it is generally offered to patients in the USA after drops have been tried (and failed), there is some evidence to suggest that laser trabeculoplasty may work better if it is done prior to drop use. Indeed, multiple studies support the use of laser trabeculoplasty as a reasonable first choice in the treatment of glaucoma.[29]

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Certain types of glaucoma seem to respond better to Laser Trabeculoplasty. Pseudoexfoliation glaucoma and pigmentary glaucoma respond particularly well to this treatment.\[30\]

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Who Should Consider Glaucoma Treatments other than Laser Trabeculoplasty

Laser Trabeculoplasty, by definition, requires that the trabecular meshwork be visible in order to apply laser to it. Those with closed or scarred angles cannot expect to benefit from this treatment. Because Argon Laser Trabeculoplasty results in post-operative inflammation it is generally not recommended for those who already have active inflammation (iritis, uveitis) in the eye. Selective Laser Trabeculoplasty (SLT), however, may be considered even in those with a history of inflammation in the eye. Laser Trabeculoplasty is also not expected to benefit those with angle-recession glaucoma (usually seen after trauma to the eye) or in infant and childhood glaucomas. Finally, its effect may be limited in eyes that have had multiple prior glaucoma operations.

The response to Laser Trabeculoplasty appears to be dependent upon the pre-treatment intraocular pressure (IOP). In other words, the higher the IOP before treatment, the better the response to Laser Trabeculoplasty. For example, Laser Trabeculoplasty can only be expected to lower the IOP by 14-16% in those with Normal Tension Glaucoma. At the other extreme, when the pre-treatment IOP is higher than 30mmHg Laser Trabeculoplasty is more...

likely to fail.[36] Thus, patients with an IOP greater than 30mmHg may not be the best candidates for Laser Trabeculoplasty.

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How To Choose Which Type Of Laser Trabeculoplasty To Have

For those who are candidates for Laser Trabeculoplasty, Selective Laser Trabeculoplasty (SLT) or Micropulse Laser Trabeculoplasty (MLT) is generally preferable to Argon Laser Trabeculoplasty (ALT) as they are less likely to result in scarring of the trabecular meshwork and Schlemm’s (drainage) Canal.

Why, then, would anyone choose to have ALT?

Certain types of glaucoma may respond very well to ALT. Pigmentary glaucoma is one of these. Of note is that eyes with heavily pigmented drainage angles are more likely to have an IOP spike after SLT. Rarely such IOP elevations have required non-laser surgery to control.[37] For these reasons, patients with heavily pigmented angles may be better served by ALT than SLT.

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Additionally, up until just recently the SLT laser had a price tag in the USA of about $70,000! Argon units, on the other hand, could be purchased for between $20,000-40,000. Additionally, an Argon laser can be used for many different types of eye treatment whereas an SLT laser is a “one trick pony”.

As you can imagine, not every eye surgeon could afford to place one of these units in the office. Now, however, both SLT and MLT lasers can be purchased for around $30,000-40,000. Although not an “impulse purchase”, a busy glaucoma surgeon can now expect to be able to afford to pay down the price of these units over a few years.

Summary

Laser Trabeculoplasty has a long track record of effectively lowering the IOP while presenting relatively low risk to those receiving this treatment. Selective Laser Trabeculoplasty has two key advantages over Argon Laser Trabeculoplasty: (1) it is repeatable; (2) it is less likely to limit future glaucoma surgical options such as the expanding number of available minimally invasive glaucoma surgeries (MIGS).

Laser Trabeculoplasty works about as well as a single glaucoma drop. Given the long-term side effects associated with chronic glaucoma drop use as well as the cost of medications most patients with open angle glaucoma should at least consider the option of SLT.
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About Dr. David Richardson

Patient-focused Ophthalmologist,

Dr. David Richardson is a Board-certified Eye Doctor in San Marino, California. He is a Magna cum laude graduate of University of Southern California and a multi-awarded Scholar of Harvard Medical School. His patient-focused approach and commitment to providing impeccable personalized care to his patients at all times have earned him many awards from both patient-rated and peer-rated award-giving bodies.

More about Dr. Richardson at David-Richardson-MD.com

You may also contact Dr. David Richardson at: (626) 289-7856