

# CUSTOM LASIK

Dr. Jeffery J. Machat

MD, FRCSC, DABO



**TLC**  
LASER EYE CENTERS  
CUSTOM LASIK INC.  
A DIVISION OF TLC LASER EYE CENTERS

Introducing...

# Dr. Jeffery Machat

## CHIEF SURGEON MD, FRCSC, DABO



A proven professional and an acknowledged leader in his field, Dr. Jeffery Machat is both pioneer, and the measure upon which excellence in laser surgery can be based. The National Medical Director and Co-Founder of TLC Laser Eye Centers, Dr. Machat has gone on to build a strong practice, and a well-earned reputation. Known for the outstanding achievements he has incurred in pursuit of professional excellence, Dr. Machat has never forgotten the many all-important elements and "small touches", that make his patients feel at ease: the well-trained team that attends his patients, the state-of-the-art equipment that graces his surgery, the warm, friendly approachable manner in which he relates to all his patients, and, of course, his own professional faith in this remarkable procedure.



Emanuel Davis (left), an NBA Basketball star and Bob Rouse (right), an NHL Hockey star have both had their eyes treated by Dr. Machat.

A few of Dr. Machat's VIP patients have included (from top): Terry Meeuwsen (Anchor 700 Club), Bob Rae (former Ontario Premier), Dan Meyers (President - North America Ophthalmics - CIBA Vision Corporation), Michael Wilson (former Finance Minister), Dr. Anthony Sensoli, MD, Dr. Brad Britton, Dr. Scott Jaben, Dr. John Mitchell, MD, and Dr. Randel Rabon.



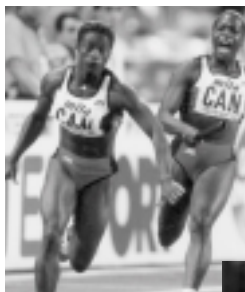


## Over a Decade of Experience

Dr. Machat graduated from Medical school in 1986 and completed his subspecialty in Ophthalmology in 1990. Upon graduation, Dr. Machat developed a highly specialized practice in laser vision correction, and has been tireless in his efforts to refine his techniques. Dr. Machat travelled to Germany and Italy in 1991 to learn PRK techniques and to Columbia, South America to learn LASIK in 1994. Certified on the Summit, VISX, Chiron, Nidek Autonomous, WaveLight Allegretto and LaserSight excimer laser systems, since 1991, Dr. Machat has performed well **over 37,000 laser refractive procedures**, including 6,000 PRK surface procedures and more than 31,000 LASIK procedures as of April 2002.

A well regarded expert in laser corrective surgery, Dr. Machat has also chosen to share his knowledge through professional papers he has written and lectures – including those lectures conducted at International Laser conferences in such places as South Africa, Brazil, Argentina, Jordan, Italy, Spain, China, Korea, Holland, Greece, Australia and France. As well, he has provided state-of-the-art training in laser refractive surgery to hundreds of surgeons around the world.

Dr. Machat is also the primary author of two important textbooks: *Excimer Laser Refractive Surgery: Practice and Principles* and *The Art of LASIK*. As a complement to his practice, Dr. Machat has also been instrumental in developing software, techniques and surgical instruments for both PRK and LASIK.



**Angela Bailey**, holder of the Canadian record for the 100 m sprint is used to being ahead of the pack – which is why she opted for the advanced technology of TLC when she wanted her eyesight enhanced.

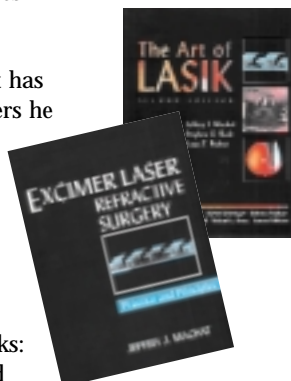
**Chris Holt** may like throwing curves, but when it came to laser surgery, Chris Holt, pitcher for the Houston Astros, played it straight choosing the the superior performance of TLC for the laser surgery he needed to stay on the ball...



**Chan Hon Goh**, great balance requires great sight which is why Chan Hon Goh, Principal dancer of The National Ballet of Canada, had the vision to come to us for her laser surgery.



Dr. Machat on VisxStar S2 with SmoothScan



“After 40 years, it truly is like a miracle!”

Heather Stubbs

## Outstanding Expertise: A First Class Reputation

As an innovator, and the first to perform LASIK in Toronto in 1994 (more than 2 years in advance of his Toronto colleagues), Dr. Machat has received outstanding media coverage both at home and abroad. He has lectured at AAO, ISRS and ASCRS. He has been quoted in Ophthalmology Times, Ocular Surgery News, and the journal of Cataract and Refractive Surgery. He has been featured on CNN and The 700 Club, TSN, Global, City TV, Prime, Body and Health, as well as many other television and newspaper reports on laser vision correction, including the Globe & Mail and National Post. In addition, Dr. Machat has been featured in such high profile magazines as Toronto Life, Canadian Business Magazine and Canadian Living Magazine.

Every year at his Toronto practice Dr. Machat performs thousands of LASIK procedures, and has experienced less than 1 in 2000 incidence of surgical flap complications. His patients come from not only Toronto and throughout Ontario, but from other parts of Canada and every state within the U.S.A. Patients have travelled from even farther, including Bermuda, Grand Cayman, England, Belgium, South Africa and Hong Kong. Among Dr. Machat's patients are high profile politicians, corporate leaders, and celebrities within the sport, entertainment and media fields. The ultimate accolade, however, comes from more than 300 doctors including neurosurgeons and ophthalmic surgeons who, in recognition of his outstanding expertise, have elected Dr. Machat as their laser corrective surgeon of choice.

Time Warner

City TV

CNN



# UNDERSTANDING

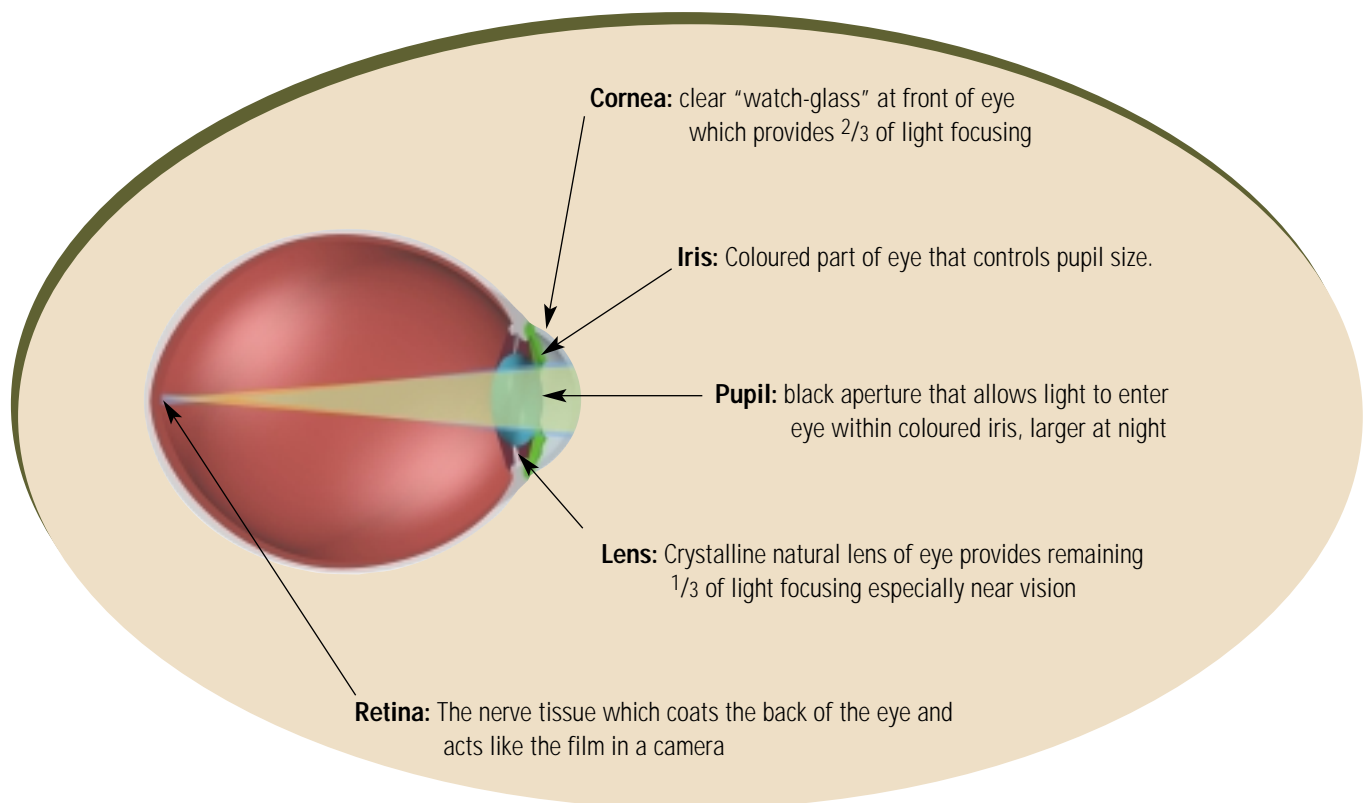
## YOUR PROCEDURE AND WHAT TO EXPECT

### Definitions, Concepts and Risks:

The anatomy of the eye is best understood if thought of as a two-lens camera system, with the cornea providing the majority of the image focusing and the natural lens providing the fine tuning or zoom of the image on the retina or film. As indicated below, the iris muscles act like the diaphragm to control the amount of light which enters the eye. Focusing problems which can be corrected with glasses or contacts are known as refractive errors, and can be corrected by prescription lenses or refractive surgery. Problems which cannot be corrected by corrective lenses usually cannot be corrected with refractive surgery. Refractive surgery encompasses any surgical technique, both laser and non-laser mediated which alter the refractive or focusing properties of the eye.

## Eye Anatomy

Below is a simplified diagram of the eye and a list of simple definitions to aid your understanding:



## Refractive Errors/Concepts:

**Myopia:** When a person has myopia or nearsightedness it simply means that they see better at near than far without any corrective lenses. Myopia is caused by an eye that is too long, or a corneal curvature that is too steep or a combination of these two factors.

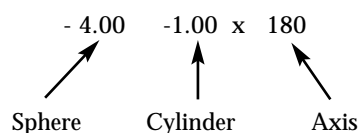
**Astigmatism:** Patients who have astigmatism essentially have an ovalness to their visual system and visual images are often blurred both at near and far distances. Occasionally patients will report doubled vision when corrective lenses are not worn.

**Hyperopia:** When a person has hyperopia or farsightedness, it simply means that they see better at far distances when their focusing muscles are relaxed than near without corrective lenses. Young and middle aged patients can use their focusing muscles to pull images into sharper view and avoid corrective lenses. However if severe, the focusing muscle strength is usually inadequate and hyperopia can compromise both far and especially near distance visual acuity. Hyperopia is caused by an eye that is too short, or a corneal curvature that is too flat or a combination of these two factors.

**Presbyopia:** Between ages of 40-50 years, all patients will experience a reduction in their focusing muscle strength requiring the use of readers or bifocals. Patients who are mildly nearsighted, having their natural focus at near, may simply remove their corrective lenses to read, however following refractive surgery will need to use readers. All “normally-sighted” patients will require reading glasses without exception. Since refractive surgery typically targets a patient “normally-sighted” for their best unaided distance vision, reading glasses will be required at some point as with every naturally “normally-sighted” patient. (see monovision option below)

**Monovision:** For patients over 40 years of age, monovision is an option that a small percentage of patients select. Typically the non-dominant eye is left mildly nearsighted to aid intermediate vision and light reading. For prolonged reading or fine print, reading glasses are still required, and night driving glasses may be needed. While teachers and office workers often prefer monovision to targeting the best distance vision in both eyes, golfers, tennis players and those with lifestyles that require substantial night driving do not.

**Prescription:** Each patient’s prescription is defined by three components:



The **Sphere** is the first component which determines the degree of nearsightedness in diopters as depicted with a “minus” sign in this example, or farsightedness which would be designated with a “plus” sign. The second component is only indicated if a patient has astigmatism and indicates the amount of **Cylinder** or ovalness, which also can be “plus or minus”. The last component is the **Axis**, which indicates the direction of the astigmatism or ovalness. The higher the sphere and cylinder in diopters (D), the more severe is the prescription and the more difficult it is to correct with laser surgery.

<b>Myopia:</b>	MILD	< -3.00 diopters
	MODERATE	-3.00 to -6.00 diopters
	SEVERE	-6.00 to -9.00 diopters
	EXTREME	> -9.00 diopters (most severe 1%)
<b>Hyperopia:</b>	MILD	< +2.00 diopters
	MODERATE	+2.00 to +4.00 diopters
	SEVERE	+4.00 to +6.00 diopters (most severe 1%)
	EXTREME	> +6.00 diopters (most severe 0.1%)
Patients with extreme hyperopia are not recommended for corneal laser refractive surgery, but may benefit from other lens refractive procedures.		
<b>Astigmatism:</b>	MILD	< -1.00 diopters
	MODERATE	-1.00 to -2.00 diopters
	SEVERE	-2.00 to -3.00 diopters
	EXTREME	> -3.00 diopters (most severe 1%)
Astigmatism may be combined with both myopia or hyperopia, and at least 50% of patients with severe myopia have at least mild to moderate astigmatism. While in the general population, mild myopia and hyperopia are most prevalent, Dr. Machat has treated literally thousands of patients with severe prescriptions.		

## Laser Refractive Procedures:

The concept behind laser refractive surgery can most easily be thought of as taking the curvature from a patient’s contact lenses or glasses and reshaping the front surface of the eye. There are three Excimer laser refractive procedures used to improve vision today, with all three utilizing the computer-controlled pulses of the Excimer laser to reshape the cornea. In the original laser procedure first performed in 1987, **Photorefractive Keratectomy or PRK** the surgeon reshapes the surface of the cornea after removing the epithelial protective layer. **Laser-in-situ Keratomileusis or LASIK**, was first performed in 1989, but it took 4-5 years for refinements before it was introduced to North America. LASIK, has certainly become the laser procedure of choice in the past 5 years because of the improved comfort and virtually overnight visual recovery for the majority of patients. In LASIK, the surgeon creates a protective corneal flap with a fine surgical instrument known as a microkeratome, then the laser pulses are applied beneath the corneal flap to reshape the inner corneal tissue. The corneal flap is approximately 30% of the corneal thickness, is typically hinged beneath the upper eyelid or nasally and is repositioned following the laser pulses. Most recently, **Laser Epithelial Keratomileusis, LASEK or EK** for short, was introduced as a surgical technique which falls between PRK and LASIK, although closer to PRK. In LASEK or EK, the corneal surface is reshaped by the Excimer laser but unlike in PRK the epithelial protective layer is preserved and replaced following the laser treatment. Custom laser applications can be combined with all three laser procedures.



Dr. Black uses the Slit Lamp Biomicroscope for corneal flap evaluation

	PRK	LASIK	EK
Anesthesia	Topical drops	Topical drops	Topical drops
Procedure length	3 minutes	5 minutes	5 minutes
Post-op Pain/Irritation	moderate	minimal	mild
Irritation Duration	1-3 days	2-6 hours	1-3 days
Visual Recovery	5-7 days	1-2 days	3-5 days
Bandage Contact Lens	Yes	No	Yes
Post-op Drops	3-4 months	2 days	3-4 months
Eyeshields	No	2 nights	No
Haze/Scarring Risk	Low	None	Low
Infection Risk	Low	None	Low
Surgeon Skill Required	Low	High	Moderate
Enhancement timing	6-9 months	2-4 months	6-9 months
Stability	3-6 months	1-3 months	3-6 months

## What to expect at the center

### Weeks before your procedure

1. Contact lens use must be discontinued well in advance of your procedure date. This allows the return of the natural curve of your cornea. Soft or disposable contacts must be removed at least 3 days prior to your procedure date and at least 1 week prior if you sleep with your contacts lenses overnight. Soft Toric contact lenses should be removed 1-2 weeks prior to surgery. Rigid gas permeable lenses must be discontinued at least 1 month before your LASIK procedure, and 2-3 months prior if you have used hard lenses for more than 20 years.
2. Prepare to be at the BCE Place Center for 2-3 hours on the day of your workup, as the equipment is presently only available at the TLC Custom LASIK vision center. Patients are advised that they will be dilated during their Custom LASIK consultation and testing.



### At your workup

1. Wavefront measurements are performed on all patients at least 24 hours prior to their Wavefront guided LASIK procedure so that the pupil can return to its natural undilated physiological size and position.
2. The WaveLight Wavefront analysis system utilizes the Tscherning principle of retinal aberrometry, which differs from Hartmann-Shack outgoing aberrometry used by most laser systems.
3. Following a complete ocular evaluation, topographical analysis is performed with both the Humphrey and OrbScan II systems. In addition, ultrasonic pachymetry, infrared Colvard pupillometry and contrast sensitivity measurements are also performed. A Tracey Visual Function Analyzer assesses contrast sensitivity, refraction and is used to correlate our Wavefront measurements, especially in complicated cases post refractive surgery.
4. Both dry and cycloplegic refractions are completed utilizing both the Wavefront data and the topographic data.
5. A floppy disc is then created for each eye with the WaveLight Allegretto Wavefront data adjusted and optimized for refractive error, effective optical zone size and corneal thickness utilizing our personal nomogram. The floppy disc is inserted into the WaveLight Allegretto laser at the time of surgery with a completely unique ablation pattern downloaded for each eye, based upon the individual characteristics of that eye much like matching a fingerprint.
6. Custom and Prolate WaveLight laser procedures are both adjusted for refractive error, age, monovision, corneal curvature, corneal thickness, pupil size and in the cases of Custom WaveLight, localized visual aberrations as well, to achieve the highest quality visual potential.



# PRK, EK AND LASIK PROCEDURE STEPS:

PRK:	LASIK:
<ol style="list-style-type: none"><li>1. Topical anesthetic drops, Antibiotic drops and Anti-inflammatory drops</li><li>2. Sedative may be taken pre-operatively at patient's request</li><li>3. Laser tested and programmed with patient treatment for each eye</li><li>4. Eyelid holder used to prevent blinking and anesthetic eliminates blink reflex</li><li>5. Patient focuses on target light as directed by surgeon</li><li>6. Corneal marker used to outline area of epithelial protective layer to be removed</li><li>7. Epithelium removed mechanically with spatula or brush or by laser</li><li>8. Eye-tracking system activated</li><li>9. Corrective laser treatment then applied, Standard, Prolate or Custom treatment</li><li>10. Anti-haze agent may be applied at this time for 30-60 seconds, then rinsed</li><li>11. Bandage contact lens inserted to protect surface during 3-5 day healing period</li></ol>	<ol style="list-style-type: none"><li>1. Topical anesthetic drops, Antibiotic drops and Anti-inflammatory drops</li><li>2. Sedative may be taken pre-operatively at patient's request</li><li>3. Laser tested and programmed with patient treatment for each eye</li><li>4. Microkeratome and new blade checked prior to each surgery</li><li>5. Eyelid holder used to prevent blinking and anesthetic eliminates blink reflex</li><li>6. Patient focuses on target light as directed by surgeon</li><li>7. Corneal alignment markings placed to help re-align corneal flap</li><li>8. Eye held with suction ring of microkeratome</li><li>9. Patients typically feel only mild pressure for about 15 seconds</li><li>10. Vision grays or darkens during suction while corneal flap is created</li><li>11. Patients do not "see or feel" the microkeratome incision, truly painless</li><li>12. Patients typically sense only vibration for 3-5 seconds during flap creation</li><li>13. Once suction and pressure released, the target light reappears</li><li>14. When the corneal flap is opened, the target light does become "sparkly"</li><li>15. Eye-tracking system activated however to ensure perfect alignment</li><li>16. Corrective laser treatment then applied, Standard, Prolate or Custom treatment</li><li>17. The corneal flap is closed, re-aligned using the corneal markings and smoothed</li><li>18. The corneal flap becomes secure within 30 seconds allowing the patient to blink</li><li>19. No anti-haze agents or bandage contact lens are required</li><li>20. Patients must wear eyeshields at bedtime for 2 nights and should not rub their eyes for 1 week</li></ol>
<b>EK:</b>	
<ol style="list-style-type: none"><li>1. Topical anesthetic drops, Antibiotic drops and Anti-inflammatory drops</li><li>2. Sedative may be taken pre-operatively at patient's request</li><li>3. Laser tested and programmed with patient treatment for each eye</li><li>4. Eyelid holder used to prevent blinking and anesthetic eliminates blink reflex</li><li>5. Patient focuses on target light as directed by surgeon</li><li>6. Diluted alcohol solution applied for 30-60 seconds to loosen central epithelium</li><li>7. Central epithelial protective layer is folded back in 4 sections</li><li>8. Eye-tracking system activated</li><li>9. Corrective laser treatment then applied, Standard, Prolate or Custom treatment</li><li>10. Anti-haze agent may be applied at this time for 30-60 seconds, then rinsed</li><li>11. Central epithelial protective layer then repositioned</li><li>12. Bandage contact lens inserted to protect surface during 3-5 day healing period</li></ol>	<p>It is important to recognize that Dr. Machat has performed literally tens of thousands of LASIK procedures and talks reassuringly, explaining what you will experience during each step of your LASIK procedure.</p>

# LASIK: OUR PROCEDURE OF CHOICE

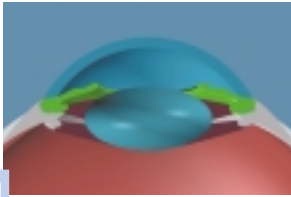
LASIK remains our procedure of choice. As noted in the previous chart, the distinct advantages of LASIK are the excellent comfort level intra-operatively and post-operatively, rapid visual recovery, ease of enhancement, reduced risks of haze, scarring and infection, and reduced need for anti-inflammatory eye drops. The distinct disadvantages are the required skill and the associated risks with the creation of the corneal flap. Surgeon experience with LASIK and improved microkeratome technology can substantially reduce the corneal flap risks to far less than 1% but can never eliminate them. The introduction of the Intralase Pulsion FS femtosecond laser to create the corneal flap virtually eliminates all risks associated with corneal flap creation (discussed later). Another significant

disadvantage to LASIK, is the need for the cornea to be thick enough to both create the corneal flap and treat the prescription, while preserving adequate tissue for long term corneal strength and stability. The Intralase technology will be of particular value to patients with high degrees of myopia as the Pulsion FS is capable of creating a thinner higher quality corneal flap, allowing more severe corrections to be treated. In patients with inadequate corneal thickness for their higher degrees of myopia, PRK or EK may be the preferred treatment. In these cases, the increased haze and scarring risk may be managed through anti-haze agents used both intra-operatively and post-operatively.

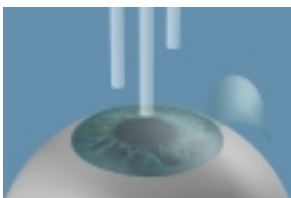
1 LASIK is an acronym for Laser in Situ Keratomileusis.

2 LASIK is the most advanced form of laser vision correction worldwide. LASIK is the most preferred technique for vision correction today.

3 LASIK reshapes the inner corneal tissue with the curvature from your prescription using a computer controlled Excimer laser.



4 A good way to understand LASIK is to think of the cornea as a book. Like the pages of a book the cornea is composed of a series of protein layers, on average about 560 layers or pages. The corneal flap would consist of the first 160 pages. The corneal reshaping would be the removal of 50-100 pages, then the book is closed and appears untouched.



5 The protective corneal flap seals through both a velcro action and an inner vacuum pressure within seconds allowing you to blink normally. A firm seal begins the next day and after 3-6 months is extremely strong. It is rare the flap will move after 24 hours unless the eye is injured.



6 The protective corneal flap in LASIK has a few distinct benefits over PRK:

- much faster healing
- improved eye comfort
- faster visual recovery
- less need for eye drops
- significantly less risk of scarring
- significantly less risk of infection
- preservation of Bowmans layer
- improved safety and ease for enhancement procedures
- improved ability to correct higher degrees of nearsightedness, farsightedness and astigmatism

7 LASIK is based on non-laser lamellar techniques practiced over the past 50 years. Most refractive surgeons are confident in the longterm safety of LASIK. Thousands of eye doctors have had LASIK themselves at TLC.



# RISKS

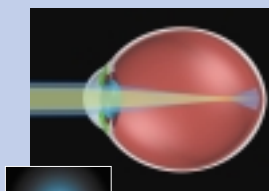
## OF LASER REFRACTIVE SURGERY

The informed consent form that each patient is required to sign prior to surgery is an extensive outline of the most important side effects and complications that patients may encounter. The form combined with your clinical consultations with our patient consultants, our optometric director and your surgeon comprise the informed consent process for each patient. Diagnostic testing helps us determine any unusual clinical findings that place a patient at higher risk for specific side effects and complications, however it is impossible to determine if any individual patient will develop problems and regret proceeding with elective refractive surgery. Our approach is simply to provide you with both information to help you make an informed decision and options with extremely advanced technology which can provide you with the safer higher quality visual results.

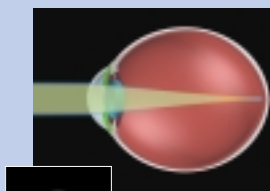
**The most important complication** is a healing or surgical problem which reduces or alters the sharpness or quality of vision a patient experiences post-operatively, which glasses do not correct. Usually Rigid Gas Permeable lenses can correct visual irregularities and restore vision to pre-operative quality and sharpness. Loss of best corrected vision is defined as the inability of a patient to read all the lines on an eyechart post-operatively that they could pre-operatively. This is due to corneal irregular astigmatism most often, and can produce visual blurring, distortion, ghosting and is typically related to irregular healing, irregular laser treatment or a corneal flap complication.

**The most common side effects** are Night Glare symptoms in the form of halos, star-bursting and ghosting. Certain risk factors such as corneal curvature, pupil size, prescription and treatment plan can dramatically affect the individual incidence of these side effects.

### WaveLight Allegretto Reduces Night Glare



Oblate shape from conventional LASIK does not focus peripheral light properly



Prolate shape with WaveLight focuses peripheral light sharply for best night vision

PROLATE SHAPE IMPROVES NIGHT VISION

Custom LASIK, PRK and EK has been found to not only reduce the risks of corneal irregularity, loss of best-corrected vision and night glare risks but can potentially correct these problems.



Colvard Infrared Pupillometer



PROCYON P2000 Pupillometer

Custom treatments have no benefit on the incidence of specific side effects and complications such as dry eye symptoms, infection, inflammation, and those which may be related to post-operative trauma such as corneal flap displacement. As well, tissue response and healing are highly variable and individual, and therefore may result in the need for secondary enhancement procedures for residual nearsightedness, farsightedness, and astigmatism. While Custom LASIK provides excellent safety with higher visual quality potential, no surgical technique can ever be guaranteed.

# CUSTOM

# LASIK

## BEYOND 20/20 WITH WAVEFRONT TECHNOLOGY

The next revolution in LASIK laser vision correction surgery are customized treatments, developing individualized software treatment plans for each patient, based upon the very unique shape and visual characteristics of that person's eye.



WaveLight Allegretto Wave Excimer Laser

Custom LASIK involves creating a truly sophisticated corneal map of the eye and then combining that with an analysis of the visual system of the eye utilizing Wavefront technology. Wavefront technology utilizes a visual Wavefront analyzer or aberrometer to study the way your eye bends light rays to improve your visual quality potential.

### The Potential Benefits of Custom LASIK:

- Greater chance of achieving 20/20 vision
- Greater chance of achieving better than 20/20 vision
- Reduced chance of losing best corrected vision
- Reduced chance of losing visual quality or contrast sensitivity
- Reduced chance of night vision disturbances and glare
- Increased ability to restore best corrected vision if healing problems develop

Custom LASIK not only improves the potential for 20/20 vision, it has the potential to restore eyes to better than 20/20 vision. The visual system is actually capable of seeing 20/10 or better, that is letters twice as small as the 20/20 letters on an eyechart. Most people cannot see beyond 20/20 because of very subtle imperfections within their visual system. Wavefront technology allows the surgeon to first map these subtle visual imperfections and then develop a laser treatment plan to correct them. The first patients ever treated worldwide with Custom LASIK were in July 1999. Using Wavefront technology in the European trials a high percentage of patients treated with Custom LASIK were able to achieve better than 20/20 vision, and even those that did not, still appreciated improvements in their night vision and contrast sensitivity.

Custom LASIK takes into account the curvature and smoothness of each cornea, the thickness of the cornea, any astigmatism and the pattern of that astigmatism, and an individual's pupil size. Wavefront technology analyzes the entire visual system from the corneal surface through the crystalline lens of the eye, all the way back to the retina. It actually looks at the whole eye and the way in which that eye sees the world to develop a truly *personalized* laser treatment plan. Wavefront analysis occurs across the entire 6mm optical center and represents a far more detailed assessment of the visual system, optimizing any imperfections to create the most ideal laser vision correction treatment pattern specific for that individual. Therefore, Wavefront technology not only provides more precise information for the treatment plan but far more information than ever before across several hundred points within the central vision zone to be treated.

Currently, all patients with - 4.00 diopters of myopia, for example, are treated with a standard LASIK program for that degree of nearsightedness. However, each patient may differ in their precise corneal shape, their corneal thickness and their pupil size, as well as any number of other variables not accounted for routinely in standard LASIK programs. While standard LASIK programs work wonderfully, the advantages of Custom LASIK cannot be overstated. Custom LASIK will create the ideal pattern for each patient taking a multitude of variables into account. Instead of utilizing just the information from your prescription and a single central reading of a corneal curvature map, Custom LASIK analyzes the entire visual system and develops a **Wavefront Map** that truly analyzes the cornea and visual system across hundreds and hundreds of points within the central vision zone. Each point mapped then guides the laser beam to provide the most ideal vision correction profile.

“Custom LASIK utilizes Wavefront technology to correct not only the prescription of the eye but to treat any subtle imperfections within the visual system to improve both the safety and visual outcome potential for patients.”



Dr. Machat enjoys a moment with one of his patients after a successful surgery.

Wavefront Technology was developed at the University of Heidelberg by astrophysicist Josef Bille Ph.D., and truly represents the next major medical breakthrough in laser vision correction. Wavefront technology has the ability to customize each LASIK treatment pattern to remove even the smallest visual irregularities and potentially achieve 20/10 vision for patients. For over a decade scientists have been developing Wavefront technology for astronomical applications, to remove the distortion effects of an imperfect atmosphere to dramatically improve their view of the universe through a telescopic lens. Based on the principles of adaptive optics, Wavefront technology removes any visual distortion or irregularity from an optical path in order to bring an object into perfect focus. Wavefront technology has now been applied to vision correction, by eliminating not only the eyes' prescription (refractive properties) but any aberrations or irregularities within the eye's visual system, to potentially improve vision beyond 20/20.

More important than better vision results is improved safety, reducing the chance for losing best-corrected vision and increasing the chance of restoring best-corrected vision.

Dr. Machat is the first surgeon in Canada to offer Custom LASIK, and one of a handful of surgeons in the world with this unique technology capability, felt truly to be the next milestone in LASIK laser vision correction. As National Medical Director for TLC Laser Centers, Dr. Machat heads their Custom LASIK center at BCE Place in downtown Toronto.

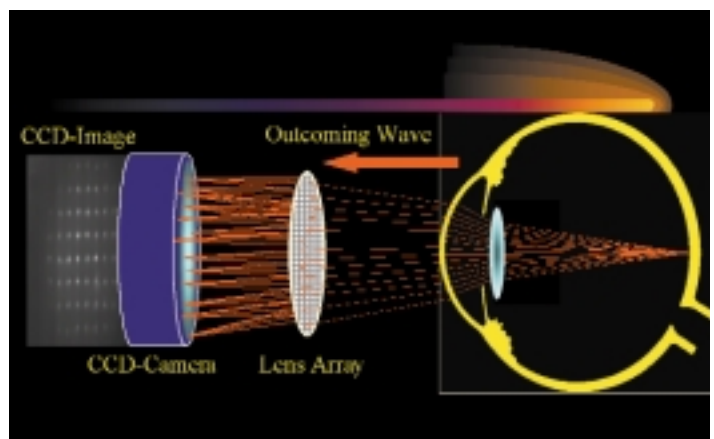
In March 2000, TLC Custom LASIK Center began providing personalized LASIK vision correction treatment programs. Utilizing flying spot technology scanning a 0.5mm-2.0mm beam across the cornea at 50 to 200 pulses per second, combined with eye-tracking technology and linked to a Wavefront Analyzer, the flying spot laser systems will allow each point within the central cornea to be treated individually and precisely. That is, flying spot technology possesses the flexibility to create an infinite number of treatment patterns to not only correct virtually any prescription with the largest treatment zones, but very subtle irregularities as well, to attain superior visual quality.

Custom LASIK takes LASIK to the next level of visual success, with lower potential for complications and greater potential for perfect vision.

This is the most revolutionary advance to occur to vision correction surgery since LASIK was introduced several years ago. For patients who have more complex prescriptions, or unusual corneal shapes or who simply want the very best technology has to offer, Custom LASIK will offer substantial benefits. Higher potential for perfect vision and lower potential for visual complications are the two primary benefits touted for the Custom LASIK approach.

### A word of caution:

It is important not to get caught up in the Wavefront hype promoted by many laser manufacturers promising “Supervision”, as only a percentage of patients will achieve vision beyond their glasses and contact lenses. It is equally important to recognize that Wavefront technology is, in our opinion, about firstly producing higher quality visual results for our patients especially for night driving and secondly, doing so with a greater safety profile. This is especially important in higher risk patients, those with complex prescriptions, large pupils, atypical topographical maps and those with some forms of amblyopia (lazy eyes). There is little doubt that Wavefront technology has superceded current non-custom laser procedures, but we are still early in development and patient healing plays a significant role in what visual result any individual patient may achieve. That is, no matter how ideal a laser ablation pattern we are able to create, there are numerous surgical and healing factors that affect the final visual outcome.



# WAVELIGHT

## ALLEGRETTO WAVE EXCIMER LASER

The WaveLight Allegretto Wave was the very first excimer laser used worldwide to perform a Wavefront guided LASIK procedure in March 1999 by Professor Theo Seiler, University of Zurich.

The WaveLight laser system was the first laser platform specifically designed for Custom LASIK, rather than being adapted for Wavefront guided LASIK as with other excimer systems. There are two proprietary software treatment programs available on the WaveLight Allegretto Excimer laser system: Prolate and Wavefront. There are a number of very unique features that make the WaveLight laser system ideal for custom ablation.

“A number of our staff, referring doctors and their families have all had Wavelight Custom LASIK procedures - that is how confident we are in this technology. In fact, Dr. Black scheduled her son for Custom Wavelight on his 18th birthday after reviewing our preliminary three month clinical results.”



Prof. Theo Seiler with Dr. Machat.

### Laser Treatment Options:

**Standard Laser** procedures treat your “prescription”, that is, the degree of nearsightedness, farsightedness and astigmatism as with glasses and soft contacts

**Prolate WaveLight** procedures treat your prescription and “spherical aberration” which acts as an Anti-Glare treatment for improved Night Vision.

**Wavefront or Custom WaveLight** procedures treat your prescription, spherical aberration and localized irregularities referred to as “coma” for the highest quality visual potential. Therefore full Custom WaveLight PRK or LASIK provides the most optimal treatment pattern, targeting your prescription, the localized aberrations within your visual system in combination with the Anti-Glare Prolate profile.

There are a number of very unique features that make the WaveLight laser system ideal for custom ablation:

1. Flying spot scanning delivery system
2. High quality Gaussian beam profile
3. Small laser spot size of 0.95mm

4. Very rapid repetition rate of 200Hz
5. Large effective optical zone of 7mm or greater
6. High frequency infrared eyetracking system (200-600Hz)
7. Wavefront-optimized ablation profiles for Prolate treatments

The small laser spot size is mandatory to produce fine complex treatment patterns. The rapid repetition rate is vital to maintain corneal hydration intra-operatively, especially in wavefront guided procedures with larger optical zones where a prolonged treatment time could adversely affect the planned treatment profile. A simple principle in laser refractive surgery is to keep the eye as physiologically hydrated as possible intra-operatively for a faster visual recovery with less risk of swelling and epithelial ingrowth. In cases of patients with night glare, the ability to create a prolate 7mm true effective optical zone with a 9mm blend zone is highly beneficial. Lastly, the eye-tracking response time must be short enough to adequately account for saccadic eye movement. The Wavelight Allegretto response time is equal or better than any other excimer laser system without the need to dilate the pupil, which allows the patient to fixate on the target light more easily with a faster visual recovery.

Standard LASIK = Prescription

Prolate LASIK = Prescription + Anti-Glare Treatment

Wavefront LASIK = Prescription + Anti-Glare Treatment + Coma: Localized Aberration Treatment



# FEATURES OF THE WAVELIGHT ALLEGRETTO WAVE EXCIMER LASER

A rapid laser pulse rate of 200 pulses per second is important when treating larger treatment zones as well as visual irregularities to maintain the natural hydration status of the cornea, which produces more predictable clinical results. The speed of visual recovery is improved while the incidence of post-operative corneal flap swelling and epithelial ingrowth is reduced with faster ablation times as well.

A true inner effective optical zone capability of 7mm for reducing spherical aberration combined with a post-operative prolate corneal shape with the WaveLight optimizes night vision.

The ability to scan complex ablation patterns with great precision, therefore a flying spot scanning system with a laser spot size less than 1mm is the most versatile.

A Gaussian energy beam profile means the beam is tapered for smoothness but combined with the 0.95mm spot size allows for improved precision.

A sophisticated eye-tracking system which on the WaveLight has a response time of 5-8 milliseconds, equivalent or better than any other in the industry, verifying position 1-3 times between each pulse placement. While the sampling rate may be greater in other systems, it is the response time that is the crucial factor preventing decentrations. With clinical symptoms beginning with decentrations of greater than 0.3mm and Wavefront ablation requiring even greater accuracy in the range of 0.2mm, the WaveLight eyetracker maintains centration within an impressive 0.1mm. The WaveLight eye-tracker automatically locks on the pupillary center and does not require dilatation of the pupil, making the procedure more comfortable for light-sensitive patients and allowing for a quicker visual recovery.

At the TLC Custom LASIK Center, new patients may take advantage of the advanced WaveLight laser technology today, which we believe provides the most sophisticated Wavefront guided platform available worldwide. The WaveLight Allegretto excimer laser system creates a custom ablation software program for each eye to produce not simply the best uncorrected visual results we have achieved but with the best visual quality. The safety profile of this laser combined with the superior night vision achieved have made it our excimer laser system of choice.

The WaveLight Wavefront Analyzer utilizes the Tscherning principle of "retinal" aberrometry, in contrast to Hartmann-Shack analysis which is based upon what is termed "outgoing" aberrometry used by most laser systems. The very sophisticated internal fundus camera within the WaveLight aberrometer, measures visual aberrations at the level of the macula for reproducible Wavefront refractive and higher order aberration data, even in most post-refractive surgery eyes. WaveLight is only one of two Excimer laser manufacturers worldwide to have developed this type of Wavefront analyzer based upon the original work by Professor Theo Seiler who performed the first Wavefront guided LASIK procedure worldwide in March 1999.



# CLINICAL RESULTS WITH THE WAVELIGHT ALLEGRETTO WAVE EXCIMER LASER SYSTEM:

The WaveLight laser platform was introduced to the TLC Custom LASIK Center in the Summer 2001 and we have been very impressed with the safety and efficacy of this laser system. The WaveLight Wavefront analysis system is highly capable of mapping a variety of complex visual aberrations, and clinical analysis of our first series of patients demonstrated a true reduction in both spherical aberration and coma post-operatively following Custom LASIK, which routinely doubles or triples following non-Custom LASIK.

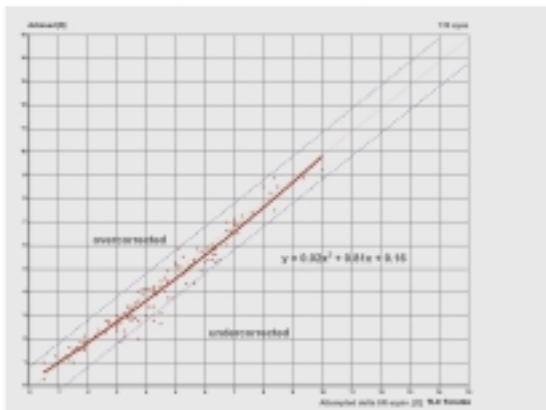
Certainly, the subjective clinical results have been outstanding with superior day and night vision reported by our patients, however we have been most impressed with the safety profile of Custom and Prolate WaveLight.

In our first series of 350 eyes, no patients have lost any best corrected vision (BCVA) and two-thirds have gained vision beyond their pre-surgery vision with glasses or contact lenses.

Furthermore, none of the WaveLight patients in our series experienced any significant night glare. In summary, the WaveLight Prolate and Custom treatments reduced the risk of healing and laser related side effects and complications. We feel that the reduced risk is primarily due to the eyetracking capabilities and proprietary laser patterns of the WaveLight laser system.

The Wavelight Allegretto excimer laser system with the Custom Wavefront program produces not only the best quantitative uncorrected visual results we have achieved in a decade but with the best visual quality. Most importantly, the safety profile of this laser combined with the superior night vision achieved has made it our excimer laser system of choice for most patients.

## PREDICTABILITY



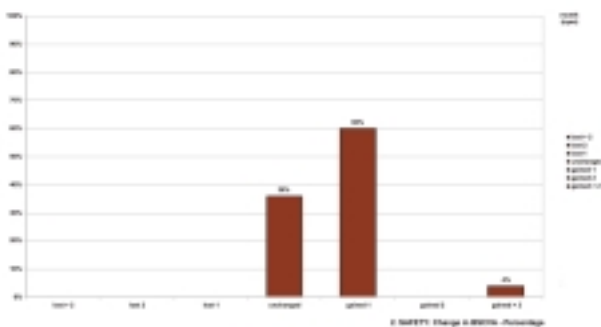
The preliminary clinical highlights of Wavefront Guided LASIK with the WaveLight Allegretto Wave Excimer Laser System:

64% improved BCVA by 1 or more lines  
0% lost BCVA

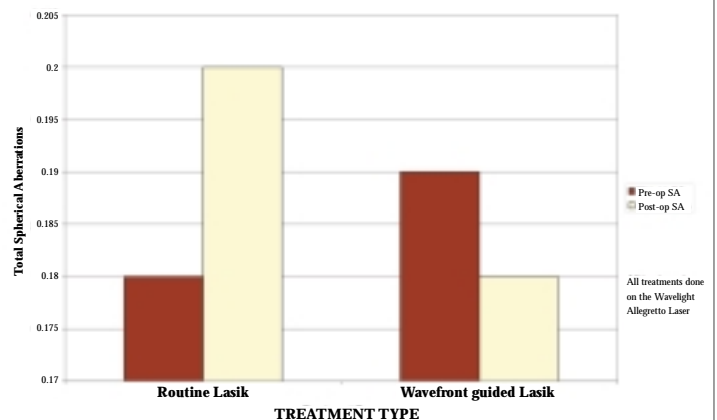
100% 20/20 or better UCVA with one or more procedures

Range of myopia -1.00 to -9.00D

## IMPROVEMENT IN BCVA

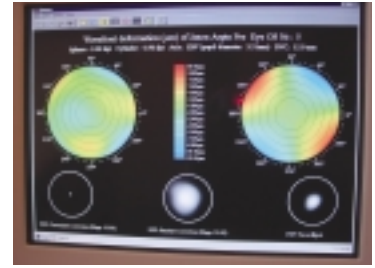


## SPHERICAL ABERRATIONS



# ZYOPTIX™

## LASER SYSTEM



The TLC Custom LASIK Center was one of the first handful of centers in the world equipped with the Bausch & Lomb Technolas 217Z Zyoptix™ Personalized Vision Correction system. After having performed the first Zyoptix™ procedure in North America in March 2000, we completed an intensive preliminary clinical trial followed by an extensive follow-up protocol to determine both the safety and effectiveness of Wavefront guided Zyoptix™. After concluding that both the safety and effectiveness of Zyoptix™ were superior to PlanoScan, our non-custom platform, we began to offer Zyoptix™ to all our patients. Zyoptix™ integrates both the OrbScan IIz multidimensional corneal analysis system and the ZyWave™ Hartmann-Shack based Wavefront Analyzer. Zyoptix™ is currently is the most commonly used Wavefront platform internationally.

The Technolas 217Z utilizes a 2mm and 1mm laser spot size to create the custom corneal treatment pattern. The flying spot scanning system operates at 50Hz and the spot size is adjusted and controlled through the patented Z-card. The 120Hz upgraded video based eyetracking system monitors the eye throughout the treatment protocol. The 2mm laser spot size is used to rapidly treat the refractive error, while in the second step, the 1mm precision beam corrects the localized aberrations, smooths the corneal surface and creates the prolate corneal shape as determined by the ZyWave™ Wavefront map.

With the next generation of Zyoptix™, expected in late 2002, we expect the benefits of the Zyoptix™ Personalized Vision Correction system to be substantially increased.

### Zyoptix™ clinical results at Custom LASIK Center:

Clinical study:

Data based on 134 eyes after 1 or more procedures with 6 month followup

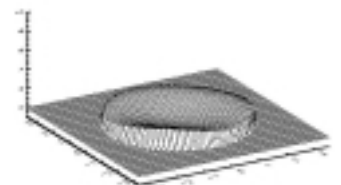
- 89% 20/20 or better
- 98% 20/25 or better
- 0% lost any BCVA
- 54% gained one or more lines of BCVA
- no reported night glare

### Reduced spherical aberration with ZYOPTIX™ for improved night vision

PreOp spherical aberration



PostOp spherical aberration



# VISX STAR S3

## ACTIVETRAK

### Visx STAR S3

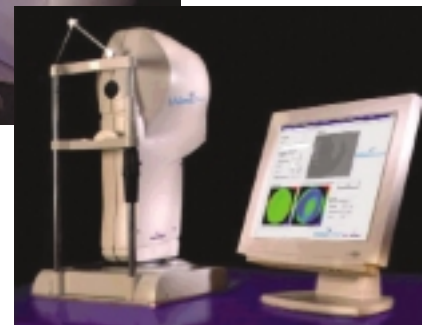
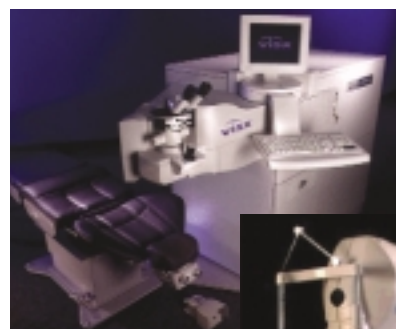
The Visx STAR S3 is the most widely used Excimer laser system in North America. Our international Visx S3 system is equipped with the ActiveTrak 3D eyetracking system, and is not only capable of performing topographically guided custom ablation with the integrated C-Cap software but is also linked to their WaveScan system for Wavefront guided ablations. The C-Cap program utilizes data from the Humphrey Topographical Analysis system to create a customized treatment plan for both new patients and those with post-refractive surgery healing complications. The WaveScan Wavefront system was developed by Professor Josef Bille, considered the father of modern Wavefront Technology and the inventor of the adaptive optics WaveScan system. The WaveScan Analysis system produces a Waveprint map utilizing the Hartmann-Shack system, which essentially "fingerprints" the visual aberrations within your visual system. The Waveprint map can then be used to create both a treatment template for true Custom PRK and LASIK or a PreVue lens. The PreVue lens is

a plastic disc lasered with your custom treatment which when viewed through, simulates your expected, but not guaranteed, post-surgical visual result. The Visx S3 utilizes a variable laser spot size ranging from 0.65mm to 6.5mm to create a variety of complex ablation profiles which minimize corneal tissue removal. The rotating seven beam array, scans the corneal surface producing a very smooth surface which can be blended out to 8.0mm to help reduce night glare. Early FDA trial data from the Visx WaveScan system is extremely promising and we expect to further develop the Custom applications utilizing our extensive experience and the Tracey Visual Function Analyzer.

Eyetracking technology with three scanning lasers provides the ability to lock on the cornea and factor out patient eye movement. It is not only reassuring for patients but vital in achieving superior visual results.

### Features of the Star S3:

1. Variable-shape beams ranging in size from .65 to 6.5 mm are scanned allowing personalized refractive treatments. The beam size is adjusted according to treatment to minimize corneal tissue removal.
2. ActiveTrak 3D eye tracking tracks an undilated pupil in all 3 dimensions of intra-operative eye movements
3. Ablation Zones which blend out to 8mm
4. Compatible with the WaveScan Wavefront System which provides personalized wavefront refractive data



# LASERSIGHT

## ASTRASCAN

The LaserSight ASTRAScan is a highly versatile flying spot scanning laser system utilizing the smallest laser spot size of only 0.8mm combined with the lowest and most refined laser fluence of 90mj/cm<sup>2</sup> for the greatest precision capabilities of any laser system worldwide. The laser repetition rate of 200Hz is equaled to the high speed infrared eyetracking system which also operates at 200 Hz, checking the eye position 200 times per second between each laser pulse placement. The true effective optical zone extends to 8mm with the potential to create the largest treatment profile of any laser system.

The LaserSight ASTRAScan utilizes both CIPTA<sup>®</sup> custom ablation software and ASTRAPro<sup>®</sup> custom ablation software based upon true elevation data. The AstraMax developed by LaserSight is a multidimensional corneal analysis system which produces true height

elevation and asphericity data which can be used in conjunction with both custom software systems. Both CIPTA<sup>®</sup> and ASTRAPro<sup>®</sup> create Prolate shaped corneal surfaces to improve visual quality and provide correction of spherical aberration for improved Night Vision. Both custom software programs can be utilized for either new or complicated post-refractive surgery patients. For patients with thinner corneas or higher prescriptions CIPTA<sup>®</sup> and ASTRAPro<sup>®</sup> remove less tissue than standard programs and can be used with PRK or LASIK.





# WHAT'S NEXT

## INTRALASE FEMTOSECOND LASER TECHNOLOGY

Using an ultrashort pulsed laser system the Pulsion FS from Intralase is capable of creating a safer and more precise corneal flap, both in quality and thickness. Each pulse of the Pulsion FS laser lasts approximately 100 femtoseconds. In one second, light travels 7.5 times around the world, in 100 femtoseconds light travels only across a human hair. The femtosecond laser virtually eliminates the risk of epithelial ingrowth, epithelial defects, as well as corneal flap complications such as free caps, button-holed flaps, incomplete and irregular flaps. As Dr. Machat's incidence of flap complications is less than 1/1000, the benefit of using an Intralase flap is yet to be realized. The prolonged visual recovery seen presently with Intralase is one of the current limitations of the system.

However another benefit is that the corneal flap thickness can be set precisely within 5 microns, to any diameter and the hinge placement at any location. The amount of intraocular pressure is reduced in half so patient comfort is improved. Recuts become much safer and a true 130 micron flap with much higher quality can be created for higher myopes with limited corneal thickness.

Dr. Machat will be pioneering the combined application of Wavefront technology and Femtosecond laser technology within the year when the technology reaches the level that Dr. Machat requires. TLC Custom Lasik Center has already been approved to be the first center in Canada with this technology.

The true capabilities of this FDA approved laser have yet to be fully realized for both primary LASIK procedures and complication management.



## SCHEDULING:

New patients are scheduled for wavefront-guided LASIK procedures on Thursdays and Fridays, but it is important to note that wavefront analysis and surgical planning must be completed 1 day to 3 months in advance.

Post-refractive surgery patients are scheduled on Mondays and Tuesdays for consultation, testing and possible retreatment surgery. In general, a complex case form must be completed and forwarded to our facility for review prior to scheduling and an information package will be sent out which includes a clinical update, informed consent forms as well as scheduling details, hotel and travel information. Patients should recognize that it is only following consultation and testing that surgical planning decisions can be made and it is possible that no surgery will be performed, surgery is recommended but at a later date, surgery is performed the following day on one eye or both eyes. Other surgical and non-surgical options will also be offered including those available at other TLC and non-TLC centers.

Telephone Numbers: 416-362-2733  
1-866-BCE-2020

For Scheduling: Susan Achal, Director of Patient Care  
Email: susan.achal@tlcvision.com

Anna, Patient Consultant - fluent in English and Italian  
Ellen, Patient Consultant - fluent in Mandarin and Cantonese

Fax Number: 416-362-1370  
WEB Site: www.customlasikinfo.com  
Email: comments@customlasikinfo.com

# POST-OP REFRACTIVE

## SURGERY COMPLICATION MANAGEMENT

Refractive surgery complications can be divided into those which are surgically induced and managed and those which are healing or ablation related and typically require further laser retreatment.

### Examples of surgical complications would be:

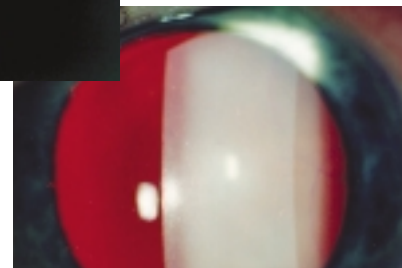
1. Corneal flap striae or displacement
2. Epithelial Ingrowth
3. Diffuse Lamellar Keratitis
4. Corneal flap irregularities: button hole flap, free cap, short flap, thin flap

### Examples of healing and ablation related complications are:

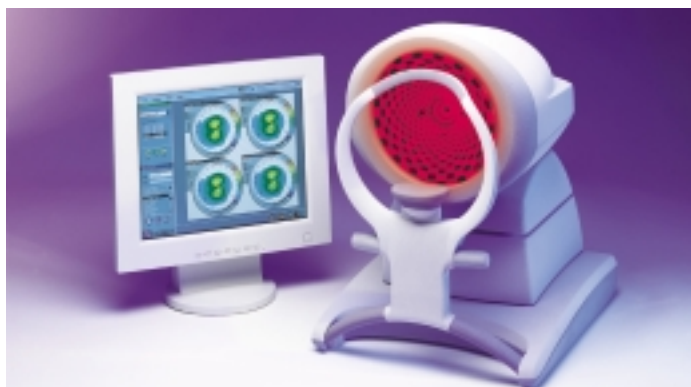
1. Topographical abnormalities: decentrations, central islands, peninsulas
2. Spherical aberrations: night glare, halos, star-bursting, ghosting
3. Irregular astigmatism: loss of best corrected spectacle vision



Post-op striae before treatment.



Post-op striae after treatment by Dr. Machat.



AstraMax Topographical Analyzer

For topographically linked retreatments, the LaserSight LSX laser is our system of choice for post-refractive surgery topographical abnormalities. It should be understood however that the diagnostic analysis is what determines the final treatment method of choice recommended to any individual patient.



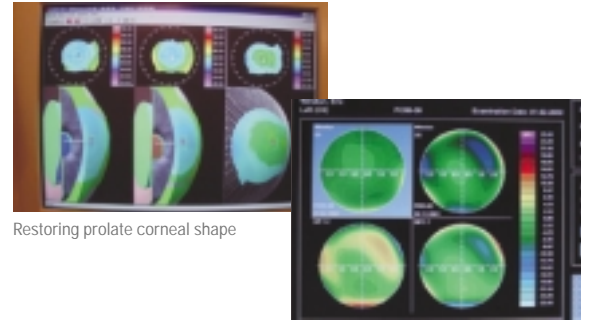
The LSX laser system possesses certain features ideal for the post-refractive surgery patient for higher quality visual results:

1. Laser spot size 0.8mm
2. Repetition rate 200 Hz
3. Eyetracking technology exceeding saccadic eye movement with automatic centration (no dilatation)
4. True Effective Optical Zones up to 8mm with blend zones of 10mm
5. Prolate cornea with planned aspheric treatment utilizing CIPTA software

The LSX laser equipped with CIPTA software utilizes true elevation data to create an idealized aspheric curve on the cornea, reducing and in many cases eliminating corneal abnormalities. Over 1000 cases have been performed in Italy and at other sites in Europe with impressive success. The computer software calculates the most ideal optical and transition zones based upon pupil size in both light and dark conditions while minimizing ablation depth for any refractive error treatment.

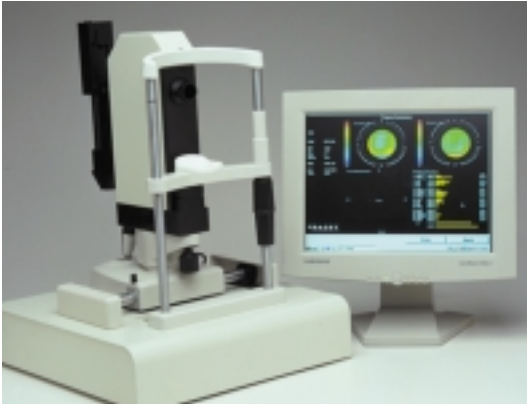


40% of Dr. Machat's patient practice is correcting visual problems from across North America following RK, PRK and LASIK. The photos on the right depict a post-operative patient that we have been able to treat using the WaveLight Allegretto Wave Laser to restore his night vision.



Restoring prolate corneal shape

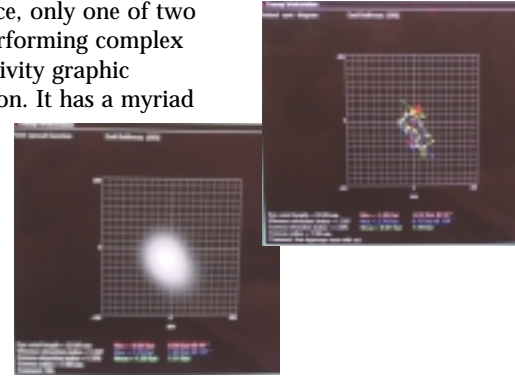
Reducing spherical aberrations with Wavefront to restore Night Vision



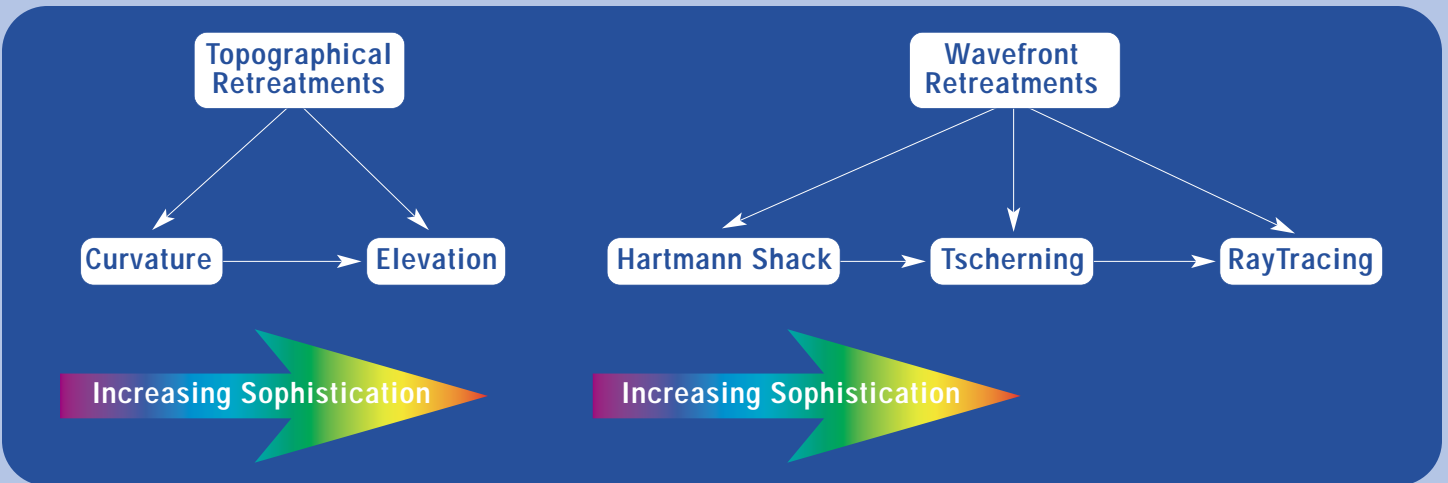
## TRACEY RAY-TRACING ANALYZER

The Wavefront device now used at BCE Place, only one of two in North America, is capable of not only performing complex visual functional analysis but contrast sensitivity graphic analysis as depicted in a point spread function. It has a myriad of unique capabilities:

- Wavefront analysis of normal eyes
- Wavefront analysis of irregular cornea
- Non-orthogonal Astigmatic axis determination
- Contrast Sensitivity assessment
- Ablation profile mapping
- Serial Tear Film assessment



## CUSTOM ABLATION RETREATMENT



### Key Points

- Wavefront technology is superior for retreatment of qualitative post-refractive surgery visual problems
- Reliable wavefront data only can be obtained in 60-70% of complex eyes presently
- It is felt that a Tracey Ray Tracing Wavefront laser link will be able to treat 100% of problems but it is still in development (late 2002/early 2003)
- Visual recovery following retreatment is SLOWER, taking up to 6 months, due to tissue response variability
- Night glare correction is most accurate at this time, certain topographically abnormalities also are readily treatable
- The future of combining raytracing wavefront data and topographical data will be most effective for irregular astigmatism
- Corneal tissue limitations are the primary concern to maintain long-term corneal stability and integrity





A few of the optometrists that Dr. Machat has treated includes: Dr. Upen Kawale, Dr. Mimmo Gagliardi, Dr. Albert Ng, Dr. Joe Elmalem, Dr. Susana Sebestyen, Dr. Casey Tepperman



Adriana,  
Professional Model

Ken Perry  
Drag Race Car Driver



Brian W. Chong, MD  
Chief, Neuroradiology, University of Utah



Elaine Larsen,  
Professional Drag Racer



Paul Gentilozzi, Professional  
Race Car Driver



Dr. Jeff Machat



Alex Castellvi,  
Professional Baseball Player



Ken Perry,  
Professional Golfer



C.J. Deere,  
Canadian Navy Diver & Pilot



Tony Galea,  
Team Doctor for  
Canadian Olympic team  
at Nagano, Japan

**TLC**  
LASER EYE CENTERS  
CUSTOM LASIK INC.

[www.tlcvision.com](http://www.tlcvision.com)  
[www.customlasikinfor.com](http://www.customlasikinfor.com)

Dr. Machat, major contributor and chairman of the capital campaign for the Daily Bread Food Bank 2001/2002.



181 Bay Street • Toronto, Ontario, Canada • (416) 362-2SEE (2733) • 1-866-BCE-2020

