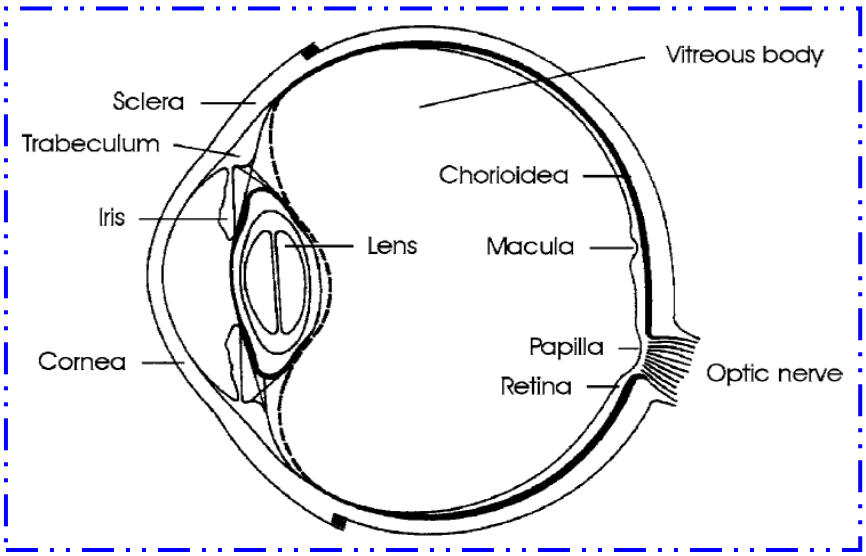
Laser in Ophthalmic Surgery

Introduction

- The introduction of lasers in Ophthalmology has had a major impact on several of the most important disorders encountered by ophthalmologists.
- In 1940's, a young Ophthalmologist Myer Schwickerath considered the idea of using light to produce a thermal reaction in the retina to produce coagulation. Thus originated the word photocoagulation.
- In ophthalmology, various types of lasers are being applied today for either diagnostic or therapeutic purposes.
- In diagnostics, lasers are advantageous if conventional incoherent light sources fail.
- One major diagnostic tool is confocal laser microscopy which allows the detection of early stages of retinal alterations. By this means, retinal detachment and also glaucoma1 can be recognized in time to increase the probability of successful treatment. In this lecture, our interest focuses on therapeutic laser applications.
- The first indications for laser treatment were given by detachments of the retina. Meanwhile, this kind of surgery has turned into a well-established tool and only represents a minor part of today's ophthalmic laser procedures. Others are, for instance, treatment of glaucoma and cataract. And, recently, refractive corneal surgery has become a major field of research, too.

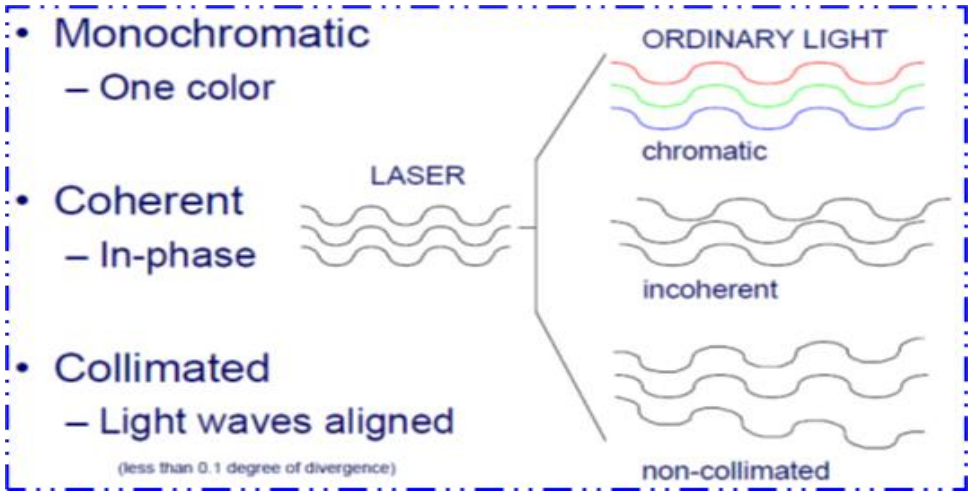
- The targets of all therapeutic laser treatments of the eye can be classified into front and rear segments. The front segments consist of the cornea, sclera, trabeculum, iris, and lens. The rear segments are given by the vitreous body and retina. A schematic illustration of a human eye is shown in the next figure



The main characteristics of LASER light

- Wavelength: Ultraviolet, Visible, and Infrared
- Power Density: Milliwatts to Kilowatts
- Duration of Pulse: Nanoseconds to Continuous
- Beam Divergence: Less than 0.1 degree
- Coherence: Millimeters to meters

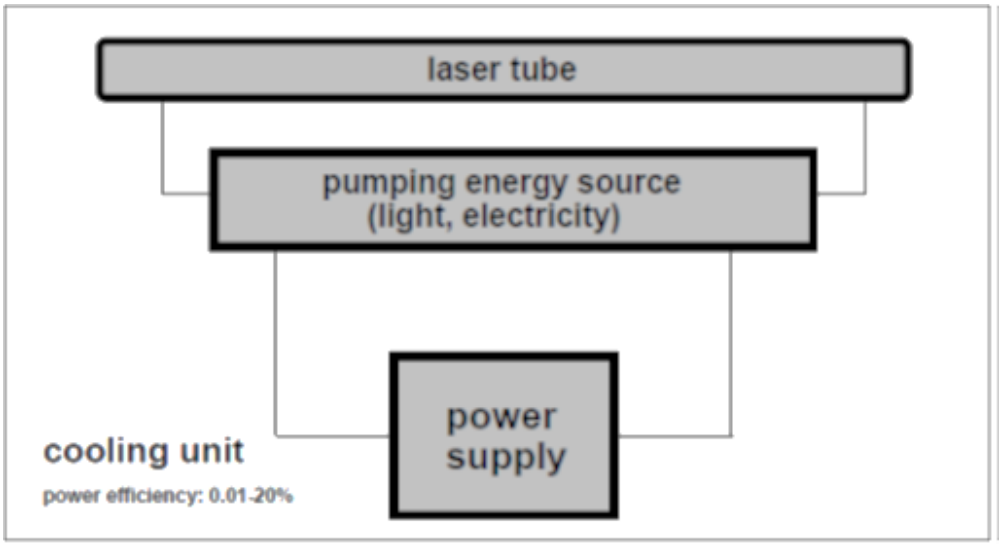
Email (amal.alzubedy@gmail.com)



Basic laser components

- Laser Tube (Laser medium + Resonating element or mirror)
- Pump or excitation sources
- Power supply
- Cooling unit (water, air)

Email (amal.alzubedy@gmail.com)



Laser Parameters

- • Power = Number of "photons" emitted each second and is expressed in watts (W).
- • Exposure time = The duration in second (sec.) the "photons" are emitted in each burn from the laser.
- • Spot size = The diameter of the focused laser beam and is expressed in micron (pin). Spot size is usually fixed for treatment of a particular lesion. However, the energy (Power x Exposure time) parameters must be decreased or increased, with the decrease or increase in the spot size parameter.
- **The spot size when focused on the retina depends on:**
- 1) Laser Spot Magnification Factor (LSMF) of the laser lens,
- 2) Spot size selected in the Slit-lamp and
- 3) Refraction of the eye under treatment.
- • Energy = Number of "photons" emitted during an exposure of any duration and is expressed in joules (J). So, Energy (Joules) = Power (Watt) x Exposure time (Second).