Laser Techniques for reshaping the Cornea

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ABSTRACT

The shape of the cornea of the eye can be modified to correct permanently for near-sightedness or far-sightedness. Heat energy can be delivered to the cornea for this purpose in order to elevate the collagen in mid-cornea to its shrinkage temperature of about 60 °C. When a suitable pattern of shrinkage is created in the peripheral cornea, the central cornea may steepen or flatten in response, and this change in curvature may serve as a refractive correction

Keywords: cornea , Laser Techniques , radiation

Laser is one of the most important types of radiation widely used in various applications. Laser generation is one of the most important physical topics.

The laser is a source for generating visible and invisible light, which is distinguished by distinctive specifications that are not found in the light emitted by the rest of the natural and industrial light sources. The word “laser” is an abbreviation of the letter

The first words of an English sentence :Light Amplification by Stimulated Emission of Radiation By the stimulated emission of radiation. The laser generates a distinct type of light that differs in its characteristics from the Natural light from the sun, stars, and artificial light from various types of lamps Electrophoresis. The laser light is distinguished by several characteristics, the most important of which are: The fact that all the light energy is concentrated in a ray of a very small cross section may not exceed in some types several micrometers square [1].

The laser travels for long distances, keeping his energy within this precise beam, And since all the light energy is absorbed.

The laser generated by the laser is concentrated within this small segment of the beam, so it is possible to obtain the intensity of illumination that may be Millions of times more intense than the light emanating from the sun or electric lights. As for the second characteristic From frequencies, unlike other types of light That is, the laser light is composed of a very narrow

beam It consists of a wide spectrum of frequencies, and therefore it appears to the eye as a white light that contains all colors The visible spectrum while the laser light appears to the eye in a single, high-purity color, such as red, green and blue [2]. The invention of the laser is considered one of the most exciting inventions of this era, as it was not considered by anyone There are countless applications of critical importance in his life That this simple light source will open door Human beings. Scientists among themselves, after the manufacture of the first lasers in 1960, wondered what the applications would be wondrous device, as the motivation behind the extensive research that led to the invention of the laser was to satisfy the curiosity of Scientists are only It is, unlike many of the inventions that must have been behind their invention. But after a few years, scientists in various disciplines chose this wonderful invention and used it in applications that are not limited to it and the latest revolution in human life that is not less than the revolution brought about by the valve to the electron and the transistor [3].

As for the doctors, they had a large share of this invention, as they used it as a high-precision scalpel that did not leave behind any bleeding. It is used to correct vision, remove tumors, lithotripsy, dental pits, arm blisters, wrinkles, carbuncles, and other diseases and skin defects [4].

The benefit of the laser beam from a medical point of view is evident in its high thermal energy It is concentrated in a very narrow diameter, and this button has proven highly efficient in surgery in general, In surgery, it is especially accurate. Day has also become a popular day in many branches of medicine These include ear, nose and throat surgery, rectal and dental diseases, and oral diseases Dermatological and cosmetic diseases include orthopedics, neurosurgery and even To guide the blind, as I have used a lot of the world's hospital in the following work Surgery for cutting, fumigation, welding or treatment [5-6].

1.2 The importance of lasers in medical science and its advantages

The most important use of lasers in surgery stems from the fact that it reduces tissue destruction, and with the goal of rapid wound healing, organ material is absorbed into the living cell by the carbon dioxide beam when focused on the tissues[7].This leads to an increase in the temperature of the cell water inside and outside, absorbing the energy of the beam, that is, to the point of its evaporation, which the tissues are cut and removed, taking into account that its effect on the surrounding tissues is much greater than 100 microns from the point of contact, which makes The recovery period is short. Since periods of pulse rate can be controlled, it ranges from 0.1 seconds to 0.1 seconds. It is a continuous pulse per second that gives the surgeon the ability to use the laser beam to vaporize the tissue or cut it as needed. Carbon dioxide with a second laser beam has the ability to weld blood vessels of less than half the diameter (mm spontaneously by coagulating blood in the open ends) [8]. This effect is performed by laser surgery in the Jag area, and there are many benefits, including reducing blood transfusions during surgery, as well as providing a new vision to the surgeon and laser work to reduce inflammation after surgery. The cells near the contact points of the rays are affected by the fact that the diameter of the beam is very small (within mm), which makes the recovery of the broken cells fast [9]. It also reduces the pain produced during surgery, because the laser beam is able to create the delicate nerve endings cut by surgery. This reduces pain to the point where sometimes anesthesia is not needed [10]. The laser beam is positioned precisely so that the button user gains full control over the burning depth of the beam, which in turn depends on the strength of the button and the exposure time with the help of the microscope, the surgeon will have a larger field of view [11].There is no risk of body movement of live cells caused by pressure, due to the lack of pressure when using a laser beam. Also, there is no risk of contamination as there is no contact between the surgical instruments and the treated tissues, in addition to the laser beam is able to evaporate pathogenic bacteria near the surgical site [12].

1.3 General risks of lasers in surgery

Every new technology requires care and follow-up to ward off the risks that may arise from it,

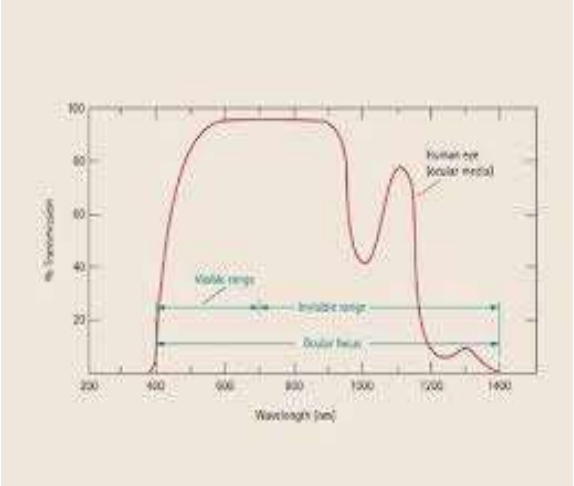
and there are some potential risks such as the dangers of laser radiation contacting combustible gases, as well as the risk of laser beams reflecting on different metal objects, and thus affecting people in sensitive areas of the body, as it may cause In skin burns or blindness upon striking the eye [13]. There are other risks that may arise from failure to follow safety and security instructions in the use of lasers to protect against internal and external combustion of narcotic substances, avoiding recyclable flammable gases when using anesthesia, in addition to protecting pipes in the conveyor. From these gases by cutting a piece of cloth saturated with salt water. In the event that there is a second button that does not reflect blue light to transfer the anesthetic gases, especially inside the endotracheal tube, this is the reason why paper plates are not used because the possibility of heat erupting in them when they come into contact with the laser rays [14].

It is also recommended to use a sterile sponge dampened with a special cloth for this product. Particularly urgent to protect carbon dioxide from button reflections from devices, carefully examine the operating room of the button. To make sure that there are no objects reflecting the laser light, use surgical instruments that are painted or covered From the outside, to prevent the reflection of rays from them and to avoid the possibility of injury to working persons[15] .

The type of coating or coating depends on the wavelength of the laser, and a protective eyes light must be used For all workers in the work room, a piece of cloth must be placed to protect The disease indicated that the formation of a fish after placing a silver-coated plastic cover on a ball The public [16].

These risks are those that are posed by exposure of non-target tissues to laser beams. Because of the intensity of the output beam and the ability of lasers to produce very high concentrations of optical power at considerable distances, these lasers can cause serious injuries to the eyes and can also burn the skin [17].

Optical risks: the majority of laser-induced ocular injuries are considered due to operator error [18]. In general and with specific reference to lasers used in dentistry, there exist two groups of wavelengths that can adversely affect the eye [19]. Wavelengths from 400-1400 nm (visible and near-infrared) can pass through the transparent structures at the front of the eye and impact on the retina (Fig.1). Longer



wavelengths (2780-10600 nm, mid- to far-infrared), will interact with the cornea [20].

Figure 1.1: Illustration of the transmissive (inverse of absorption) nature of visible and near-infrared wavelengths through the cornea, lens and associated structures.

Above 1,400 nm, there is increased absorption by the water content of these structures. In terms of the scope for repair, retinal injuries are more serious. Due to the focusing ability of the lens, a 1 mW (0.001 W) laser beam, passing to the back of the eye, results in a retinal irradiance more than 300 W cm^{-2}, well above the ablation threshold. Visible wavelengths may selectively destroy red or green cones, resulting in some colour blindness, although the majority of retinal laser burns affect complete areas of tissue due to the predominance of invisible wavelengths in dental lasers. Retinal injury may initially pass unnoticed, due to the lack of pain receptors [21-22]. Longer wavelengths will interact with structures at the front of the eye, causing ablation, scarring and distortion of vision (Fig. 2).

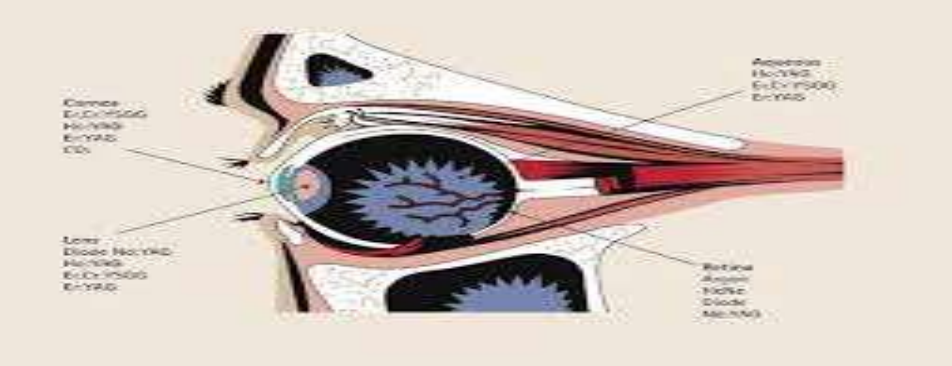


Figure 1.2 : Wavelength/site risk analysis of the eye

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Non-pigmented structures towards the front of the eye will be most at risk from longer wavelengths, whereas retinal structures are at risk from short infrared and visible wavelengths.

1.4 Ensure the safety of laser devices

Before any use, the properties of the laser beam, such as the congruence of the laser beam, must be verified from seeing the esophagus with directed visible beams, as well as the value and intensity of the beam at the point of contact. With the texture, the direction of the laser beam, the focus point of the rays, the amount of beam energy with the work and the presence of an art trained in the use of laser devices and the characteristics of their beam for periodic examination, suitable for devices and beams, and to ensure their safety and correctness of the required characteristics, and not to allow people to use the button to use it, and in general it is necessary to check the type of surgery Scheme, such as cutting or vaporization of tissue and healing them together and their compatibility with the laser used, in addition to testing the density of the appropriate vessel for the tissue to be worked on [23-24].

1.5 Laser uses in treating eye diseases

Laser is known as the collection and amplification of light rays in a manner that makes them a powerful incendiary or cutting force, and is used in a simplified manner in the treatment of many diseases of the eyes, skin, throat and other parts of the body [25-26].

Lasers are widely used to treat many eye conditions [27]. Where the laser is used in two forms, one of which is a burner called argon, krypton, or laser diode. And the other type has a cutting force, meaning that there are two beams of radiation that meet at one point, and when their strength is sufficient, a cut takes place in the tissue to which the rays were directed. These types are called YAG laser, which is a cold laser [28]. There are also other types of lasers such as Alaximr laser used to correct refractive errors. In fact, the lasers used in treating eye diseases are painless rays, and in most cases a person does not need more than an anesthetic drop to surface of the eye before performing the laser operations [29].

1.5.1 Cases that can be treated with the burning lasers

First: Treatment of retinopathy in diabetic patients is of two types:

1- A partial treatment in which abnormal blood vessels are blocked, which cause the secretion of proteins that accumulate in parts of the retina, which affect visual acuity, and sometimes before this treatment with laser beams, a retinal dye must be performed to find places of weakness in the vessels To facilitate precise laser ironing.

2- Complete treatment of all parts of the retina. This treatment is required when there is a growth of additional and abnormal blood vessels on the surface of the retina, and often there is bleeding from the blood vessels that supply the retina, and there are fibrosis on the surface of the retina or between the retina and vitreous fluid. The process is summarized in the cauterization of many inactive cells at the edges of the retina, so that the weak blood vessels can transport blood and nourish the sensitive places in the retina, such as the focal point (the yellow spot), and this is the case for retinal cells, as there is not enough blood for all of them. Therefore, it is necessary to destroy the

unimportant cells and keep food only for the important cells, which are the macula and around it [30].

Second: The use of burning lasers in the treatment of some types of glaucoma (blue water):

Argon rays and the like are used in the treatment of some types of open-angle glaucoma, by shedding lasers with a weak burning power on the retinal tissue of the corner of the eye responsible for the drainage of eye fluids. To widen the holes in that mesh fabric. This does not mean that the use of lasers is necessary to treat glaucoma, but rather that it may be useful in limited types only, depending on the condition [31].

Third: The burning lasers are used to weld the weak parts of the retina when there are openings or holes in them, which are often a cause of retinal separation.

Use of laser beam cutter:

These rays are used in many eye diseases such as:

1- Making a small opening in the edges of the iris when there is acute glaucoma due to the narrowing of the outer corner of the eye, and this opening drains eye fluids into the anterior chamber of the eye, and this operation is very safe and is performed in an outpatient clinic.

2- Tearing the back of the lens of the eye, which is left during cataract operations, in order to keep the vitreous fluid from moving forward, and to maintain the balance of the artificial lens inside the eye in the first weeks of cataract operations, and this membrane may change its transparency after a period of the operation and weaken Seeing as a result, which requires making an opening in the middle of this membrane in order to improve vision. It is a simple and safe operation, and it does not need rest or any precautions after the operation

3- Diode laser is used to treat some intractable types of glaucoma in order to weaken the ciliary body, which secretes fluids that cause high eye pressure or the so-called glaucoma or glaucoma, and is also used in the treatment of retinopathy in premature babies.

Fourth: The use of CO_2 laser to treat occluded tear ducts:

Where work began recently with modern laser technology, which is the CO_2 laser to treat blockage of the tear duct, as this disease is more common and this device provides a better service for patients, as the patient is not anesthetized with general anesthesia, but rather local anesthesia and medical scalpels are not used, but the operation is by inserting A small tube through the nose to open the blockage in the tear duct with the **CO_2**laser [32].

Fifth: the use of excimer laser rays:

The Excimer laser is used in operations to correct myopia, farsightedness and astigmatism, and this type of laser is also used to remove surface corneal opacities, due to the ability of this type of laser to vaporize and remove the surface tissues of the cornea that it touches, and this laser modulates the corneal surface according to the type of treatment required. For example, if it is required to treat myopia, the laser will straighten the center of the cornea to reduce its curvature, and if the treatment is for farsightedness, the laser will alter the corneal surface to increase the curvature in the center of the cornea, and this modulation is through very accurate computer programs and gives almost guaranteed results, especially if it is The programming of these devices is accurate and their maintenance is regular. This type of laser is very safe, and its success has been proven on a large scale, and the devices used have evolved to give the most accurate and safest results.

The scalpel is the latest innovation of the LASIK process, and the idea of the scalpel is based on a scientific fact, which is that if the laser beams are shed for a very short period, the rays do not burn tissues, hence the idea of using lasers, which is an infrared laser that can treat tissue with high precision and less heat, unlike what is generated by regular laser treatment, which is an important asset in the world of laser eye surgery

The laser device emits a very small laser pulse, the extent of which does not exceed 100 millimeters from the infrared laser, for a very short period, this period of a femtosecond. That is, one in a million billionth of a second, it was found that the laser pulse, despite the strength of the energy present in it, but shedding it inside

the cornea for this short period makes it turn into a very small bubble, which separates the tissues from each other without causing any damage to the neighboring tissues. And the laser device, or more precisely, a "femtosecond laser" device, can make any cut that we want as surgeons [33] .

1.6 Corneal defects and refractive surgeries

God has blessed us by creating for us two eyes with which we see the world, but this organ, like the rest of the other members, may have some abnormalities.

The cornea abnormalities can be corrected by wearing glasses or surgery, but what is the cornea? [34].

The cornea: It is the part of the eye that works to help focus the light entering the eye to make the image on the retina, just as the camera lens that focuses the light entering the film works, and this process can be called (light refraction): It is the bending and focusing of light on A point on the retina. Sometimes the shape of the cornea of the eye is imperfect, so the image formed on the retina outside the focus is blurred and blurred. These defects are called (refractive defects)[35].

There are three main types of refractive defects, which are: farsightedness, myopia and astigmatism.

-People who suffer from nearsightedness have difficulty seeing distant objects as clearly as very close objects.

-As for people with farsightedness, they have difficulty looking at close objects, but they can see distant objects clearly.

-As for astigmatism, the image on the retina is distorted. As a result of defects in the cornea or lens of the eye. Sometimes astigmatism is associated with farsightedness or astigmatism with nearsightedness, and eyeglasses or eye lenses have been designed for them in order to correct vision defects [36].

1.7 Laser Hazard classifications:

Lasers are classified into four categories based on their danger to live cells. When dealing with the laser should be Pay attention to the sign that explains his classification.

Figure 1.3: Laser warning signal

The types of lasers are classified according to safety laws in international standards based on the degree of their harm to the human body, and it must be reminded that most of the damage resulting from the use of lasers is not due to its rays, but due to the misuse of the energy sources needed for some lasers, especially large ones, including high-voltage power generation devices or materials. As for the damage caused by its rays, it is mostly to the eyes of the user, and this does not mean that it is not dangerous for other organs. The damage it may cause depends [37].

The human eye has a laser on the following:

1. Duration of exposure to radiation.
2. Radiation intensity.
3. The color of the laser (or what is known as the wavelength).

The danger of the laser to the eye:

The maximum undamaged human eye light intensity is about 5 micro joules per square centimeter. And since the energy that the human eye is exposed to decreases as it moves away from the source of the laser beams, the safety distance is the minimum distance between the eye and the laser device, so that if

the eye is exposed to a direct laser pulse, it will not be damaged. This distance varies according to the following factors [38]:

A - The condition of the weather.

B - Optical zoom devices used in vision devices.

C - Harmful Reflections.

D - The degree of focus of the laser beam.

E - The type of laser beam, pulsed or continuous

- Class 1 and 1M lasers are safe under reasonably foreseeable conditions of operation. Class 1M can be hazardous if the beam is viewed with **magnifying** optical instruments (hence the letter 'M' is added).
- Class 1C lasers are used in medical and cosmetic applications. The laser is only applied when the emission port (aperture) is in contact with target tissue such as skin.
- Class 2 and 2M lasers emit visible light at higher levels than Class 1, but eye protection is provided by aversion responses such as the human blink reflex. Class 2M lasers can be hazardous if the beam is viewed directly with magnifying optical instruments.
- Class 3R lasers produce visible and invisible light that are hazardous under direct viewing conditions. There is low risk for eye injury provided the exposure time is short. There is no risk for skin injury.
- Class 3B lasers produce visible or invisible light that is hazardous under direct viewing conditions; either they are powerful enough to cause eye damage in a time shorter than the human blink reflex (0.25 seconds) or the blink reflex is by-passed due to the invisibility of the beam. Laser products with power output near the upper range of Class 3B may also cause skin burns.
- Class 4 lasers are high power devices capable of causing both eye and skin burns, their diffuse reflections may also be hazardous and the beam may constitute a fire hazard [39].

TABLE 1.1
Laser Hazard Classification

Class	Basis for Classification
Class 1: Safe Visible and nonvisible	Lasers that are safe under reasonably foreseeable conditions of operation; generally a product that contains a higher-class laser system but access to the beam is controlled by engineering means.
Class 2: Low power Visible only	For CW lasers, protection of the eyes is normally provided by the natural aversion response, including the blink reflex, which takes approximately 0.25 sec. (These lasers are not *intrinsically* safe.) AEL = 1 mW for a CW laser.
Class 1M: Safe without viewing aids 302.5 to 4000 nm	Safe under reasonably foreseeable conditions of operation. Beams are either highly divergent or collimated but with a large diameter. May be hazardous if user employs optics within the beam.
Class 2M: Safe without viewing aids Visible only	Protection of the eyes is normally provided by the natural aversion response, including the blink reflex, which takes approximately 0.25 sec. Beams are either highly divergent or collimated but with a large diameter. May be hazardous if user employs optics within the beam.
Class 3R: Low and medium power 302.5 nm to 1 mm	Risk of injury is greater than for the lower classes but not as high as for class 3B. Up to 5 times the AEL for class 1 or class 2.
Class 3B: Medium and high power Visible and nonvisible	Direct intrabeam viewing of these devices is always hazardous. Viewing diffuse reflections is normally safe provided the eye is no closer than 13 cm from the diffusing surface and the exposure duration is less than 10 sec. AEL = 500 mW for a CW laser
Class 4: High power Visible and nonvisible	Direct intrabeam viewing is hazardous. Specular and diffuse reflections are hazardous. Eye, skin and fire hazard. Treat class 4 lasers with caution.

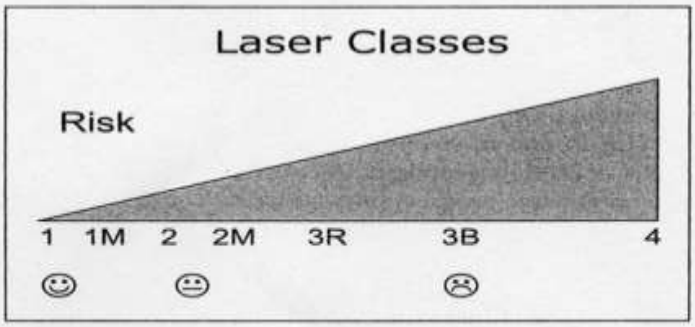

FIGURE 1.2 Risk vs. hazard classification.

Figure 1.4: Laser Hazard Classification

2.1 Introduction

This chapter deals with the use of lasers in ophthalmology, describes the models in lasers, excimerizer technology, which made it possible to reshape the surface of the cornea with great precision.

In which the surface cells of the cornea were removed before the laser operation, and this technique was the most popular until the beginning of the nineties, when it was developed with the introduction of what is known as With laser assistance in localized keratitis, which caused a major breakthrough in eye refractive defects surgeries where all the side effects of PRK were avoided. In terms of lack of pain after the operation, rapid improvement of looking the next day, treatment of a greater proportion of degrees of myopia, etc., in which a thin layer of corneal tissue is

lifted and the laser is performed and then returned again.

2.2 The type of device used

Excimer Laser is one of the latest scientific findings in treating refractive defects of the eye. And in it, low-wave ultraviolet lasers are used to modify the surface of the cornea, thus changing its refractive power. These rays remove layers of corneal tissue with pinpoint accuracy, with precisely defined length and depth. LASIK excimer operations correct astigmatism 6 degrees, farsightedness 6 degrees, and short sightedness 14 degrees. 97% of patients treated with this technique got a 40/20 vision ratio, and 85% got 25/20 vision. During the laser procedure, there are those who monitor the process and watch it, through a computer located within the excimer laser whose task is to determine the exact amount to be removed from the corneal tissue while maintaining the survival of the tissues soft and smooth

The laser device sheds a beam of rays on the corneal tissue to be treated, which leads to the removal of these particles from the cornea and thus changes its refractive power. In the event that these rays are shone inside the corneal tissue, it is called Lasik. In the case of shining rays on the surface of the cornea, it is a superficial treatment called a laser (PRK), and this device targets specific tissues without affecting the surrounding tissues.

Before performing the operation, the person undergoes tests that include measuring the strength and weakness of the patient's eyesight, conducting a topographic scan of the cornea, measuring its thickness, examining the retina and the optic nerve, and measuring intraocular pressure.

One of its most important advantages is that it uses the self-sterilizing cold laser technology that does not have any negative effects on the tissues of the eyes.

As well as the infinite accuracy in tracking eye movement during the operation, as the device was provided with three infrared light sources at a speed of 400 times per second for accurate follow-up, which is a speed higher than the speed of the eye, and the device also deals significantly with relatively high degrees of shortness and farsightedness.

It also deals with cases of deviation and diffraction of vision with various available techniques, which were developed by the German Professor Seiler, who is the first ophthalmologist in the world to use these techniques to treat difficult cases that are impossible to treat with regular devices.

It also deals with cases of "deviation" as well as "diffraction of vision", which were not available in previous devices, indicating that this technology represents a revolution in the field of surgery to correct visual defects in order to obtain the maximum improvement in vision in terms of quantity and quality.

That the device gives accurate and effective results in a period ranging between 9-14 seconds as a maximum, and that the procedure of secondary surgery after the primary surgery using the Legreto device is the lowest in the world and that the speed of the operation does not result in the accumulation of many fluids, which usually takes a lot of time to absorb. It is the case with other devices. In addition to the aforementioned features, the device eliminates nightly driving problems after the operation, and it is also possible to return to work the day after the operation directly.

Figure 2.1: Excimer laser deviceFigure

2.2.1 Types of excimer laser operations and what are their complications

There are two types: 1) Surface treatment: includes PRK-LASIK - EPI LASIK. For surface treatment operations, the excimer laser is applied to the outer surface of the cornea after dealing with the surface layer of the cornea, and the three types differ from each other in the way of dealing with the surface layer of the cornea, and then a contact lens is placed for three days. Complications include delayed wound healing, an increase or a lack of treatment or opacities on the surface of the cornea, and these complications are considered simple and few and do not cause blindness, and the most annoying of some patients in the surface laser process is the pain that occurs as it lasts for a period ranging from one to two days to and Its severity varies from person to person.

2) LASIK, which is a process of shedding excimer laser beams on the inner layers of the cornea, where a portion of the cornea is cut by an electronic or laser scalpel at 270 degrees, after which the cut part is bent and laser beams are shed on the inner layers of the cornea, and then the cut part of the cornea is returned To its natural place without stitching. Complications of LASIK surgery are few, including complications related to the cutting process, such as an incomplete cutting process, which leads to delaying the procedure for a period of 3 months, or the cutting process is irregular or complete 360 degrees, so that the cornea is cut in a circular motion. Also, these complications may be represented in the failure of the cut cornea to return to its normal place after completing LASIK, and this only needs to return the cut part to its normal place.

Among the complications is the emergence of blood spots under the conjunctiva, although it is not harmful, but annoying to the patient and it takes days to weeks to go away.

There are complications related to the laser shedding process, such as if the laser treatment is more or less than what is required to be treated, and the patient may not focus during the operation on the light specified for him, which leads to the occurrence of astigmatism, or it may lead to a lack of focus of the treatment in the middle of the cornea.

There are also complications that may appear after the operation, such as infections inside the eyes, or instability of the cut part of the cornea in its normal place, and this is usually due to the fact that the patient did not abide by the instructions not to rub the eyes, so the doctor returns the cut part to its normal place. It is possible that some deposits may occur inside the cornea, which requires re-cleaning, and some late complications may occur with a slight curvature of the cornea.

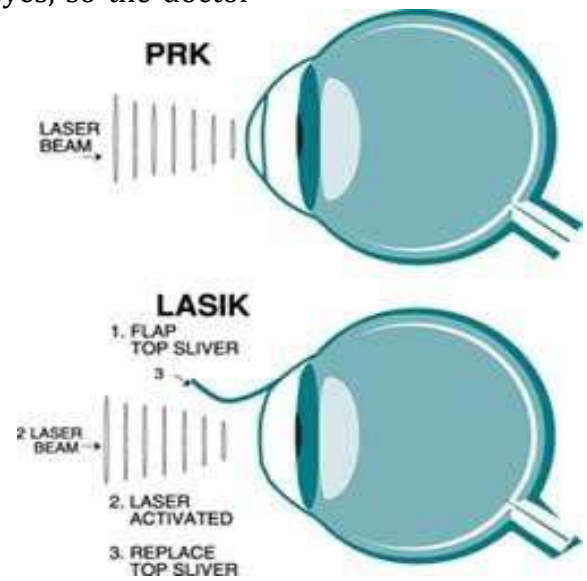

Figure 2.2: Excimer laser operations

2.2.2 The aim of these operations

Get rid of the glasses or the lens. -

--Remove the opacity or the cloud (P.T.K) on the outer layers of the cornea, whether that opacity is due to a genetic disease or due to an occasional disease that affects the eye, leaving behind an opacity on the cornea.

Complications after the operation 2.2.3

With the administration of the appropriate medications, things will go well, and in general, LASIK operations cause slight pain that disappears within a few hours after the operation and the patient gets the required vision immediately. As for PRK operations, it is accompanied by severe pain sometimes, especially on the first day of the operation and begins to disappear gradually during the three days. The first and the patient need a longer period to get the desired result.

Process 2.2.4

After the pupil-dilating substance is instilled into the eye, a local anesthetic is also instilled into the eye. In the next stage, the surgeon directs thin laser beams towards the cornea without making an incision or any change of the corneal location. The lasers change the angle of the cornea, so that the rays of light entering and falling into the eye can more accurately reach the retinal tissue at the bottom of the eye. The lasers used in this procedure can cause the cornea to shrink or slightly change its shape.
In this way, the visual disturbances caused by the mismatch between the image produced in the cornea of the eye and the resulting image on the surface of the retina (which is transmitted through the optic nerve fibers to the brain for analysis) are corrected. This process takes no more than a few minutes.

Figure2.3: The surgeon directs thin laser beams towards the cornea

Liquids used in the eye 2.3.

The term intraocular pressure refers to the pressure of the fluid inside the eye, which is called aqueous humor.

It is a liquid similar in structure to plasma, but it contains a small amount of protein, which gives it clarity to not block the blocking of light from passing through, and it is located between the cornea and the lens of the eye.

The eye pressure is responsible for giving the eye its circular shape, in addition to it contributes to regulating the passage of nutrients and oxygen from the blood to the tissues of the eye, and this is done by the pressure difference between the blood vessels in the eye and the aqueous mixture.

The eye pressure is considered normal if its ratio ranges between 10-20 mm Hg, and the eye suffers from eye pressure if it exceeds the normal limit.

It is measured using a precise device called a tonometer, which measures the pressure of one or both eyes.

2.3.1 Laser eye pressure treatment

Blue water, glaucoma, or black water are the names of a disease that arises as a result of high pressure in the eye. As a result, damage to the tissues of the optic nerve leads to the loss of the retinal nerve cells.

As well as cataract or cataract disease, which is not as dangerous as glaucoma, as it can be treated by replacing and implanting a lens?

Lasers may be effective in different types of glaucoma, and lasers are used in one of two ways, depending on their type:

- Open angle glaucoma: where the laser beams treat the drainage insufficiency itself. The laser is used to expand the angle of drainage to maintain eye pressure within normal limits.
- Closed angle glaucoma: The laser creates an opening in the iris to improve the flow of aqueous fluid to the angle of drainage.

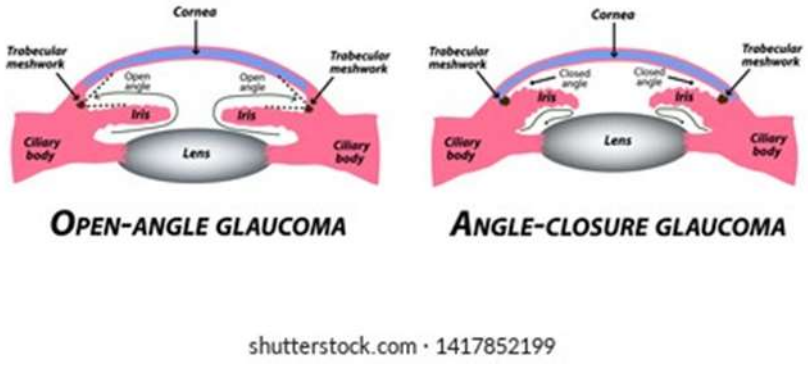

Figure 2.4: Types of Glaucoma

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3.1 Introduction

This chapter explains the results of the work in this research, and attempts to survey them with conclusion and discussion.

The rate of recovery from the operation 3.2

In general, most people who undergo laser localized keratoplasty (LASIK) achieve visual ability of 20/25 or better, and this is appropriate for most activities. However, most people will need glasses for driving at night or reading as they get older. LASIK surgery has a good track record. Rarely, complications leading to vision loss occur, and most people are happy with the results. Some side effects, such as dry eyes and temporary visual disturbances, are fairly common. But these effects usually wear off after a few weeks or months, and this problem remains in the long term for a very small number of people.

results depend on the nature of refractive error and other factors. People who have mild myopia often have more successful results from refractive surgery. But the results are more difficult to predict for people with severe nearsightedness or farsightedness in addition to astigmatism.

Causes of poor eyesight after laser surgery 3.3

-Lack of availability of the correct conditions for LASIK surgery from the beginning, such as the appropriate age and the patient's vision stability.

. The patient's advanced age, especially after the age of forty -

-Infection with some diseases such as high blood pressure, diabetes, white water, or a weak cornea of the patient .

- The cornea does not heal naturally after the operation, which causes the appearance of white spots, which leads to poor vision again. It is a rare condition that occurs due to the naturalness of the patient's body.

-The patient's condition may allow the LASIK process to be repeated if the thickness of the cornea is appropriate, and otherwise the patient is committed to using lenses or eyeglasses, the doctor may prescribe some cortisone drugs, but it may lead to serious side effects, and it may be advised for transplantation, but it is a process that needs severe examinations.

action of the laser beam 3.4

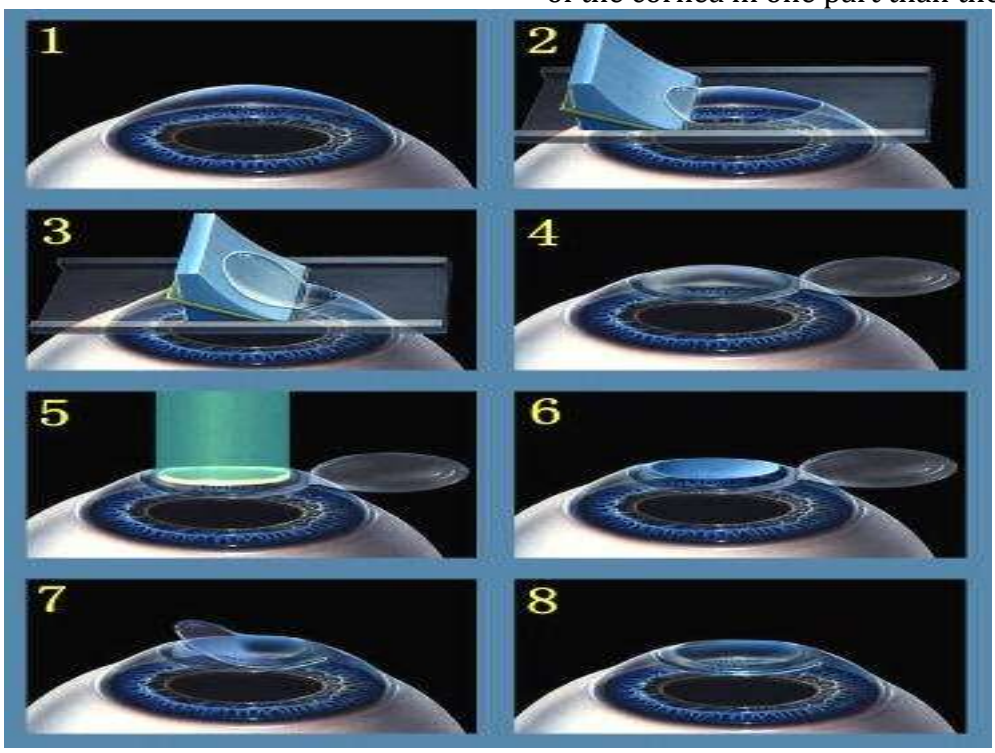
The laser beam reshapes the surface of the cornea as follows:

-In myopia, it is treated by making the central part of the cornea flatter by scraping a certain degree of the central part of the cornea.

-In farsightedness, it is treated by making the central part of the cornea more convex by

scraping a certain degree of the peripheral or outer part of the cornea.

-In astigmatism, it is treated by making the cornea more spherical by removing more layers of the cornea in one part than the other.



3.1 Laser eye surgery: Figure

Conclusions:

Laser vision correction procedures lead to a decrease in the measurement of intraocular pressure 1-3 months after the operation.

Changes in the thickness of the cornea, corneal topography and corneal impedance to intraocular pressure devices, causing the wrong drop in eye pressure by the Coldman device, which gives a false impression of eye pressure for patients with glaucoma and high intraocular pressure, which causes problems in their treatment independently.

This type of surgery is not considered a medical necessity, because limited vision can be overcome through non-surgical means (glasses / lenses), but the patient often performs it for comfort or beauty purposes.

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