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Use of 980 nm diode laser in the treatment of second and third degree haemorrhoid

A dissertation

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بسم الله الرحمن الرحيم

وَإِذَا مَرِضْتُ فَهُوَ يَشْفِينِ

صدق اللَّهُ العظيم

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ABSTRACT

Background: Haemorrhoids are a common anorectal problems worldwide, which affects many peapoles per year. The incidence could be as high . Haemorrhoidal veins normally occur in the human body, When these veins become dilated they turn to a morbid condition called haemorrhoidal disease. Straining promotes the congestion of these veins and speeds the development of the hemorrhoids. The complains are, bleeding, nodule, spoilage, itching, pain and symptomatic prolaps. In most cases, the surgeon interferes when conservative measures have failed, or complications such as thrombosis have occurred. Conventional haemorrhoidectomy is the surgical excision. In this procedure severe pain, or complications may occure. laser haemorrhoidectomy is one of the popular alternative methods of treatment, it allows vaporization or excision of the hemorrhoid, it seals small blood vessels allowing a bloodless field, it seals superficial nerve endings giving the patient no or minimal post-operative discomfort. Lasers mainly used to cut , coagulate , vaporize or remove tissue. Proper use can reduce blood loss, decrease postoperative discomfort, reduce the chance of wound infection decrease the possibility of cancer spread, gives limited fibrosis and stenosis.

Aim of study: Use of 980nm-diode laser for second and third degree haemrhoidectom and evaluate the side effect and any possible complications.

Patients, Materials & Methods: A prospective study including 10 patients with symptomatic second and third degree haemorrhoids submitted to laser haemorrhoidectomy by diod 980nm laser from the period between August 2020 to February 2021. Patients ages ranged from (32-55) years old with mean 45.3 years. Preoperative evaluation to record all the necessary information. Medical and surgical histories were taken from the patients with clinical examination for each patient.

Results*:* most patient experience no pain during the operation, mild to moderate pain in 9 patients (90%) and sever in 1 patients (10%) in the first postoperative day. For all (100%) patients there was a disappearance of the haemorrhoid. no one of them need a second session of laser treatment. There was no recurrence detected during the follow up period which was 4 weeks after the laser haemorrhoidectomy.

No patient had significant primary bleeding, only 1 patients (10%) developed wound infection, one patient (10%) complaining from difficulty to urinate, non one of them suffered from neither anal stenosis nor fecal incontenance.

Conclusion: The clinical application of the 980nm diode laser in surgical procedures prove to be of beneficial effect for daily practice, it can be considered practical, effective, easy to use, offers a safe, acceptable, and impressive alternative for conventional techniques of surgical treatment in second and third degree haemorrhoid.

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List of Abbreviations

Abbreviations	Item
cm	*Centimeter*
CO_2	*Carbon dioxide*
CW	*Continuous wave*
IR	*Infrared*
J	*Joule*
mm	*Millimeter*
mW	*Millwatt*
Nd:YAG	*neodymium:Yttrium-Aluminum-Garnet*
MPE	*Maximum permissible exposure*
nm	*Nanometer*
OD	*Optical density*
p	*Power*
PDT	*Photodynamic therapy*
Uv	*Ultraviolet*

Introduction

Haemorrhoids are one of the most common benign anorectal problems worldwide, which affects more than one million individuals per year.[1] The incidence could be as high as 36.4%. Haemorrhoidal veins normally occur in the human body. When these veins become dilated they turn to a morbid condition called haemorrhoidal disease. Straining promotes the congestion of these veins and speeds the development of the haemorrhoids; heredity also plays an important role and it is common to observe many cases in a same family. Pregnancy, weightlifting, and anything that increases intra-abdominal pressure contribute to vein dilation.[2] They are useful for anal canal physiology, especially on the time of defecation. They have two useful functions, first for protection of anal canal mucosa, second for anal continence at rest by complete closure of anal canal. Haemorrhoid disease, describe to situation that causes symptom and troubles to the patient. The complains are, *bleeding, nodule, spoilage, itching, pain and symptomatic prolaps*.[3] In most cases, haemorrhoids are treated conservatively, and the surgeon is contacted when conservative measures have failed, or complications such as thrombosis have occurred. [4] Surgical excisions (Milligan and Morgan) reported a surgical procedure for haemorrhoids which had been passed, down to the present time which is the basis of conventional hemorrhoidectomy.[5] in this procedure severe pain, bleeding, infection, stenosis and recurrence may occure. CO2 laser haemorrhoidectomy is one of the popular alternative methods of treatment, it allows vaporization or excision of the haemorrhoid, it seals small blood vessels allowing a bloodless field, it seals superficial nerve endings giving the patient no or minimal post-operative discomfort.[6] Lasers in general surgery were mainly used to cut , coagulate , vaporize or remove tissue . The majority of " laser surgeries " actually use the laser device in place of other tools such as scalpels , electro- cautry, cryosurgery. It was propose that laser allow surgeons to accomplish more complex tasks.[7] Proper use can reduce blood loss, decrease postoperative discomfort , reduce the chance of wound infection , decrease the possibility of cancer spread, gives limited fibrosis and stenosis due to high degree of control over lateral damage, minimize the extend of surgery in selected circumstances, and if they are used appropriately by skilled and properly trained surgeons it result in better wound healing .[7] laser is useful in both contact and non-contact modes depending on the wave length and the particular clinical applications.[8]

Aim of study

The aim of the study is evaluate the effectiveness and safety of 980 nm- diode laser used for second and third degree haemrrhoidectom .

Introduction

1.1 The anatomy of anal canal

The anal canal is the final segment of the gastrointestinal tract. It has an important role in defecation and maintaining faecal continence.

The anal canal is located within the anal triangle of the perineum between the right and left ischioanal fossae. The canal begins as a continuation of the rectum and passes inferoposteriorly to terminate at the anus.[9]

1.2 Anatomical Structure

Except during defecation, the anal canal is collapsed by the internal and external anal sphincters to prevent the passage of faecal material.

Anal Sphincters play a crucial role in the maintenance of faecal continence, internal anal sphincter – surrounds the upper 2/3 of the anal canal. It is formed from a thickening of the involuntary circular smooth muscle in the bowel wall. External anal sphincter – voluntary muscle that surrounds the lower 2/3 of the anal canal (and so overlaps with the internal sphincter). It blends superiorly with the puborectalis muscle of the pelvic floor.[9]

At the junction of the rectum and the anal canal, there is a muscular ring – known as the anorectal ring. It is formed by the fusion of the internal anal sphincter, external anal sphincter and puborectalis muscle, and is palpable on digital rectal examination.[9]

1.3 Internal Structure

The superior aspect of the anal canal has the same epithelial lining as the rectum (columnar epithelium). However, in the anal canal, the mucosa is organised into longitudinal folds, known as anal columns. These are joined at their inferior ends by anal valves. Above the anal valves are small pouches which are referred to as anal sinuses – these contain glands that secrete mucus.

The anal valves collectively form an irregular circle – known as the pectinate line (or dentate line). This line divides the anal canal into upper and lower parts, which differ in both structure and neurovascular supply. This is a result of their different embryological origins:[10]

Above the pectinate line – derived from the embryonic hindgut.

Below the pectinate line – derived from the ectoderm of the proctodeum.

Inferior to the pectinate line, the anal canal is lined by non-keratinised stratified squamous epithelium (known as the anal pecten). It is a pale and smooth surface, which transitions at the level of the intersphincteric groove to true skin (keratinised stratified squamous).[10]

1.4 Neurovascular Supply and Lymphatics

the pectinate line divides the anal canal into two parts – which have a different arterial supply, venous drainage, innervation and lymphatic drainage. [11] Table (1-1)

Table (1-1) **Neurovascular Supply and Lymphatics of anal canal**[11]

Modality	Above Pectinate line	Below Pectinate line
Arterial Supply	Superior rectal artery (branch of inferior mesenteric artery) Anastomosing branches from the middle rectal artery.	Inferior rectal artery (branch of the internal pudendal artery) Anastomosing branches from the middle rectal artery.
Venous Drainage	Superior rectal vein, which empties into the inferior mesenteric vein (portal venous system).	Inferior rectal vein, which empties into the internal pudendal vein (systemic venous system).
Nerve Supply	Visceral innervation via the inferior hypogastric plexus. Sensitive to stretch.	Somatic innervation via the inferior rectal nerves (branches of the pudendal nerve) Sensitive to pain, temperature, touch and pressure.
Lymphatics	Internal iliac lymph nodes	Superficial inguinal lymph nodes

1.5 Hemorrhoid

Hemorrhoids, also spelled **haemorrhoids**, are vascular structures in the anal canal.[12] In their normal state, they are cushions that help with stool control.[13] They become a disease when swollen or inflamed; the unqualified term "hemorrhoid" is often used to refer to the disease.[14] The signs and symptoms of hemorrhoids depend on the type present.[15] Internal hemorrhoids often result in painless, bright red rectal bleeding when defecating. External hemorrhoids often result in pain and swelling in the area of the anus. If bleeding occurs it is usually darker. Symptoms frequently get better after a few days. A skin tag may remain after the healing of an external hemorrhoid.[15] While the exact cause of hemorrhoids remains unknown, a number of factors that increase pressure in the abdomen are believed to be involved. This may include constipation, diarrhea, and sitting on the toilet for a long time. Hemorrhoids are also more common during pregnancy. Diagnosis is made by looking at the area. Many people incorrectly refer to any symptom occurring around the anal area as "hemorrhoids", and serious causes of the symptoms should be ruled out. Colonoscopy or sigmoidoscopy is reasonable to confirm the diagnosis and rule out more serious causes.[13]

1.6 Signs and symptoms

In about 40% of people with pathological hemorrhoids there are no significant symptoms. Internal and external hemorrhoids may present differently; however, many people may have a combination of the two. Bleeding enough to cause anemia is rare, and life-threatening bleeding is even more uncommon. Many people feel embarrassed when facing the problem and often seek medical care only when the case is advanced.[14]

1.6.1 External haemorrhoid

If not thrombosed, external hemorrhoids may cause few problems. However, when thrombosed, hemorrhoids may be very painful. Nevertheless, this pain typically resolves in two to three days. The swelling may, however, take a few weeks to disappear. A skin tag may remain after healing. If hemorrhoids are large and cause issues with hygiene, they may produce irritation of the surrounding skin, and thus itchiness around the anus.

1.6.2 Internal haemorrhoid

Internal hemorrhoids usually present with painless, bright red rectal bleeding during or following a bowel movement. The blood typically covers the stool (a condition known as hematochezia), is on the toilet paper, or drips into the toilet bowl. The stool itself is usually normally coloured. Other symptoms may include mucous discharge, a perianal mass if they prolapse through the anus, itchiness, and fecal incontinence. Internal hemorrhoids are usually painful only if they become thrombosed or necrotic.[14]

1.7 Pathophysiology.

The exact cause of symptomatic hemorrhoids is unknown. A number of factors are believed to play a role, including irregular bowel habits (constipation or diarrhea), lack of exercise, nutritional factors (low-fiber diets), increased intra-abdominal pressure (prolonged straining, ascites, an intra-abdominal mass, or pregnancy), genetics, an absence of valves within the hemorrhoidal veins, and aging. Other factors believed to increase risk include obesity, prolonged sitting, a chronic cough and pelvic floor dysfunction. Squatting while defecating may also increase the risk of severe hemorrhoids. Evidence for these associations, however, is poor.[13] Hemorrhoid

cushions are a part of normal human anatomy and become a pathological disease only when they experience abnormal changes. There are three main cushions present in the normal anal canal. These are located classically at left lateral, right anterior, and right posterior positions. They are composed of neither arteries nor veins, but blood vessels called sinusoids, connective tissue, and smooth muscle. Sinusoids do not have muscle tissue in their walls, as veins do.[18] This set of blood vessels is known as the haemorrhoidal plexus.

Hemorrhoid cushions are important for continence. They contribute to 15–20% of anal closure pressure at rest and protect the internal and external anal sphincter muscles during the passage of stool. When a person bears down, the intra-abdominal pressure grows, and hemorrhoid cushions increase in size, helping maintain anal closure. Hemorrhoid symptoms are believed to result when these vascular structures slide downwards or when venous pressure is excessively increased. Increased internal and external anal sphincter pressure may also be involved in hemorrhoid symptoms.Two types of hemorrhoids occur: internals from the superior hemorrhoidal plexus and externals from the inferior hemorrhoidal plexus. The pectinate line divides the two regions.[18]

1.8 Diagnosis

Hemorrhoids are typically diagnosed by physical examination. A visual examination of the anus and surrounding area may diagnose external or prolapsed hemorrhoids. A rectal exam may be performed to exclude a possible rectal tumors, polyps, an enlarged prostate, or abscesses. Visual confirmation of internal hemorrhoids may require anoscopy, insertion of a hollow tube device with a light attached at one end. The two types of hemorrhoids are external and internal. These are differentiated by their position with respect to the pectinate line. Some persons may concurrently have symptomatic versions of both. If pain is present, the condition is more likely to be an anal fissure or an external hemorrhoid rather than an internal hemorrhoid.[18]

Internal haemorrhoids originate above the pectinate line. They are covered by columnar epithelium, which lacks pain receptors. They were classified in 1985 into four grades based on the degree of prolapse, as shown in

figure (1-1).

Grade **I**: No prolapse, just prominent blood vessels

Grade **II**: Prolapse upon bearing down, but spontaneous reduction

Grade **III**: Prolapse upon bearing down requiring manual reduction

Grade **IV**: Prolapse with inability to be manually reduced.

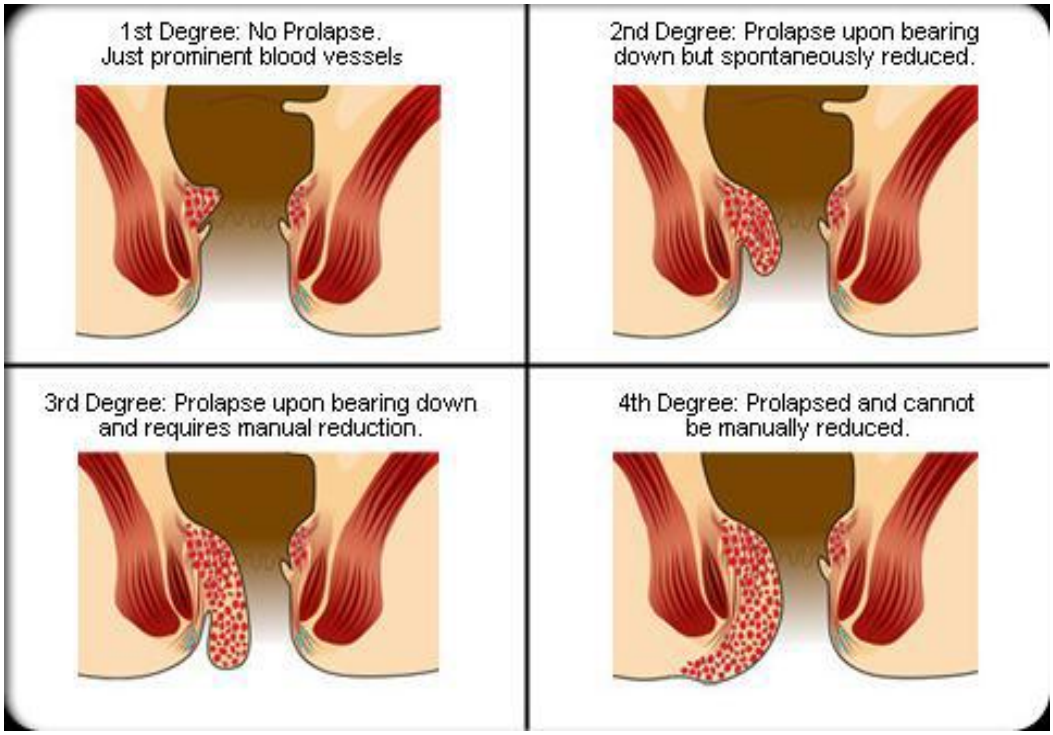


Fig. (1-1): Grades of Haemorrhoids[13]

External haemorrhoids occur below the dentate (or pectinate) line. They are covered proximally by anoderm and distally by skin, both of which are sensitive to pain and temperature.[13]

1.9 Differential diagnosis

Many anorectal problems, including fissures, fistulae, abscesses, colorectal cancer, rectal varices, and itching have similar symptoms and may be incorrectly referred to as hemorrhoids. Rectal bleeding may also occur owing to colorectal cancer, colitis including inflammatory bowel disease, diverticular disease, and angiodysplasia. If anemia is present, other potential causes should be considered.[16]

Other conditions that produce an anal mass include skin tags, anal warts, rectal prolapse, polyps, and enlarged anal papillae. Anorectal varices due to increased portal hypertension (blood pressure in the portal venous system) may present similar to hemorrhoids but are a different condition. Portal hypertension does not increase the risk of hemorrhoids.[15]

1.10 Prevention

A number of preventative measures are recommended, including avoiding straining while attempting to defecate, avoiding constipation and diarrhea either by eating a high-fiber diet and drinking plenty of fluid or by taking fiber supplements, and getting sufficient exercise. Spending less time attempting to defecate, avoiding reading while on the toilet, and losing weight for overweight persons and avoiding heavy lifting are also recommended.[19]

1.11 Management

1.11.1 Conservative

no specific treatment is needed. Initial measures consist of increasing fiber intake, drinking fluids to maintain hydration, NSAIDs to help with pain, and rest. Medicated creams may be applied to the area, but their effectiveness is poorly supported by evidence. A number of minor procedures may be performed if symptoms are severe or do not improve with conservative management. Surgery is reserved for those who fail to improve following these measures.[14]Approximately 50% to 66% of people have problems with hemorrhoids at some point in their lives.[14] Males and females are both affected with about equal frequency. Hemorrhoids affect people most often between 45 and 65 years of age, and they are more common among the wealthy.[15] Conservative treatment typically consists of foods rich in dietary fiber, intake of oral fluids to maintain hydration, nonsteroidal anti-inflammatory drugs, sitz baths, and rest. Increased fiber intake has been shown to improve outcomes and may be achieved by dietary alterations or the consumption of fiber supplements. Evidence for benefits from sitz baths during any point in treatment, however, is lacking. If they are used, they should be limited to 15 minutes at a time. Decreasing time spent on the toilet and not straining is also recommended.[32]

While many topical agents and suppositories are available for the treatment of hemorrhoids, little evidence supports their use. Most agents include a

combination of active ingredients. These may include a barrier cream such as petroleum jelly or zinc oxide, an ansthetic agent such as lidocaine, and a vasoconstrictor such as epinephrine.[13]

1.11.2 Surgery

A number of surgical techniques may be used if conservative management and simple procedures fail. All surgical treatments are associated with some degree of complications including bleeding, infection, anal strictures and urinary retention, due to the close proximity of the rectum to the nerves that supply the bladder. Also, a small risk of fecal incontinence occurs. Excisional haemorrhoidectomy is a surgical excision of the hemorrhoid used primarily only in severe cases. It is associated with significant postoperative pain and usually requires two to four weeks for recovery.[20]

the laser is widely used in anal surgery, The commonly used laser energy in medicine are carbon dioxide, argon, and Nd:YAG.[20]

1.12 Laser Basic Principles

1.12.1 Basic configuration of a laser system

The acronym LASER shortly describes the process that generate laser light: Light Amplification by Stimulated Emission of Radiation. In this process, photons are emitted and amplified by atoms and molecules in a special optical volume.[21]

All lasers, regardless of size, shape, style, or application, have three main components **Figure (1-2).**

1. Active medium

The active medium is a collection of atoms, molecules or ions that absorb energy from an outside source and generate laser light by stimulated emission. [18] The active medium can consist of a **solid**, **liquid**, gas or a **semi-conductor** material. **Solid state as** Nd: YAG laser. **Liquid as** dye laser. **Gas, as** CO_2 gas laser. **Semiconductor**, diode laser.

2. Excitation mechanism

Excitation mechanisms pump energy into the active medium by one or more of three basic methods; **optical**, **electrical** or **chemica**l to create a population inversion. for a laser to create a "population inversion" where most or all of the particles are in the excited state, this is achieved by adding energy to the laser medium (usually from an electrical discharge or an optical source such as another laser or a flash lamp); this process is called pumping, [19] most common optical pumping by flash lamp, electrical pumping by electrical current, chemical reaction pumping, or the use of another laser light source. [21]

3. Optical Resonator:

Reflect the laser beam through the active medium for amplification. It is consisting of:-High Reflectance Mirror: A mirror which reflects 100% of the laser light. Partially Transmissive Mirror: A mirror which reflects less than 100% of the laser light and transmits the remainder.

The resonant cavity thus accounts for the ***directionality*** of the beam since only those photons that bounce back and forth between the mirrors lead to amplification of the stimulated emission. Once the beam escapes through the front mirror it continues as a well-directed laser beam. However, as the beam exits the laser it undergoes diffraction and does have some degree of spreading. . Even more, the resonant cavity also accounts for the ***amplification*** of the light since the path through the laser medium is elongated by repeated passes back and forth. Typically this amplification grows exponentially.

If the direction is parallel to the optical axis, the emitted photons travel back and forth in the optical cavity through the lasing material between the totally reflecting mirror and the partially reflecting mirror. The light energy is amplified in this manner until sufficient energy is built up for a burst of laser light to be transmitted through the partially reflecting mirror; most lasers have three or more levels. [21]

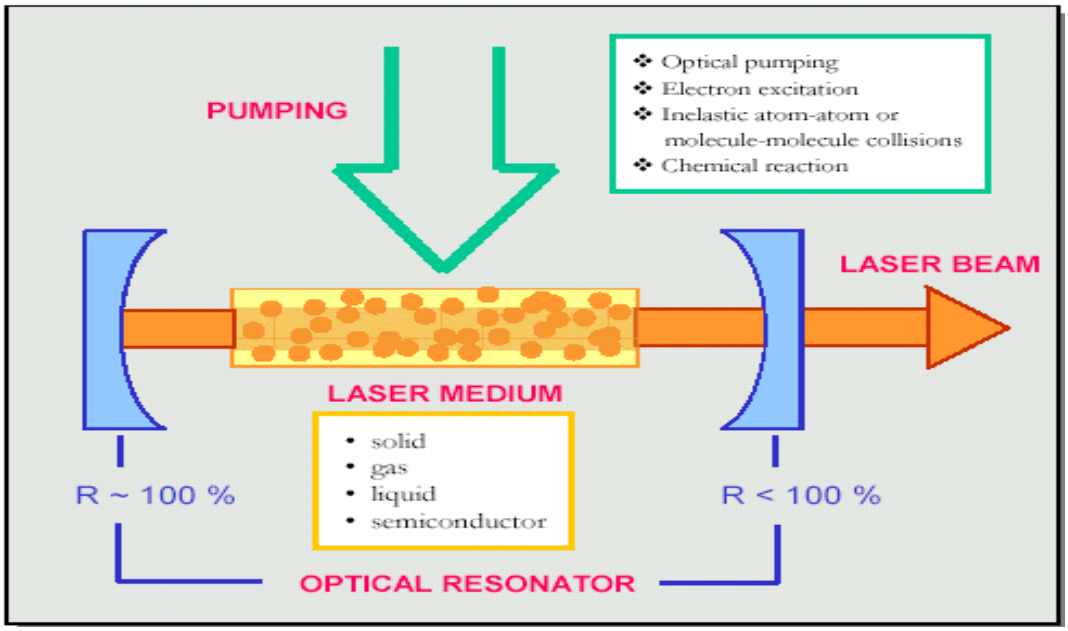


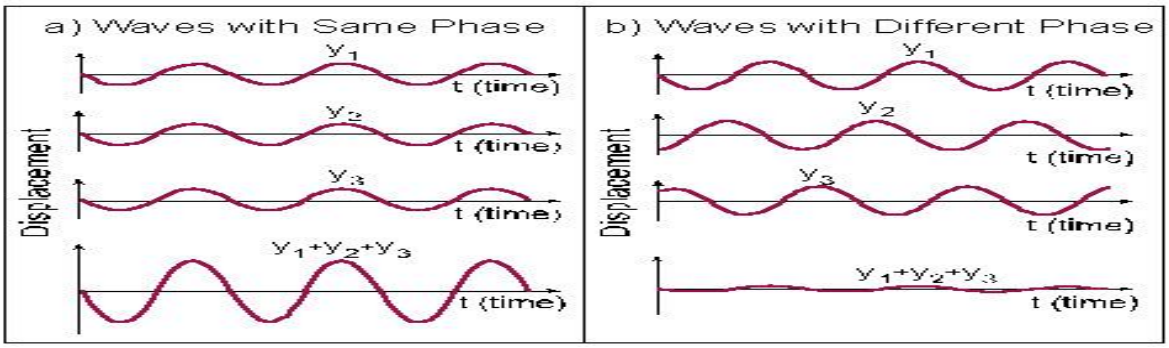
Figure (1-2) Laser Components[21]

1.12.2 Properties of laser light:

Unlike ordinary light, laser light is **coherent, collimated, monochromatic, directionality, and brightness**.[24]

1- ***Coherent:*** refers to synchronized phase of light waves, where all individual waves are in step or 'in –phase,' with one another at every point. So "coherence" is the term used to describe the in – phase property of light waves within a beam (figure 1-3).

(a)Coherent Light **(b) Incoherent Light**



Figure(1-3) (a)-Coherent Light+ (b)- Incoherent Light [22]

2- Monochromatic: refers to single wavelength (color) of a laser beam. Ordinary white light is a mixture of colors, as can be demonstrated by passing ordinary light through a prism, will be dispersed into its components wavelengths (colors) **Figure (1-4)**.

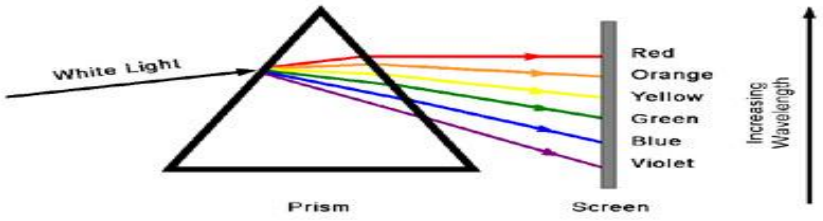


Figure (1-4) Dispersion of white light by a prism. [24]

3- Collimated: refers to the parallel nature of the laser beam, it is emitted in a very thin beam, with all light rays parallel. By focusing and defocusing this beam, a surgeon can vary its effects on tissue.

4-Directionality: divergence of beam is very small **figure(1- 5).**

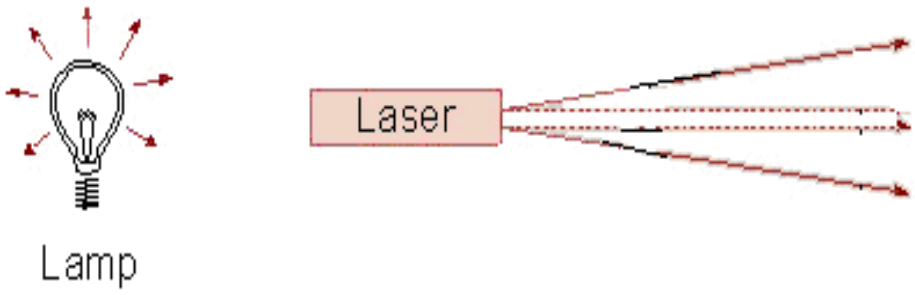


Figure (1-5) (Difference between Light Bulb & Laser and its Directionality)[27].

5- Brightness: refers to the wave that contains a lot of energy. These properties allow a laser of a given power to be immensely more powerful than ordinary light of the same power.[24]

These unique characteristics make the laser useful for thousands of applications including medical applications.

1.12.3 Laser beam modalities

Laser may be divided into two broad groups **Figure (1-6).**

1. Continuous wave (CW) laser. 2. Pulsed laser.

A CW laser is one whose power output undergoes little or no fluctuation with time. It exhibits a ***steady flow*** of coherent energy. Helium neon and argon gas lasers are typical examples, and are measured as ***power in watts.*** A larger group of lasers has output beams that undergo ***marked fluctuations*** i.e. beam power changes with time and said to operate in the "Pulsed mode". Nd: YAG solid crystal lasers and CO2 gas lasers often, but not always, is operated in pulsed mode, and is expressed as ***energy in joules, & peak power*** =output energy / pulse duration.[27]

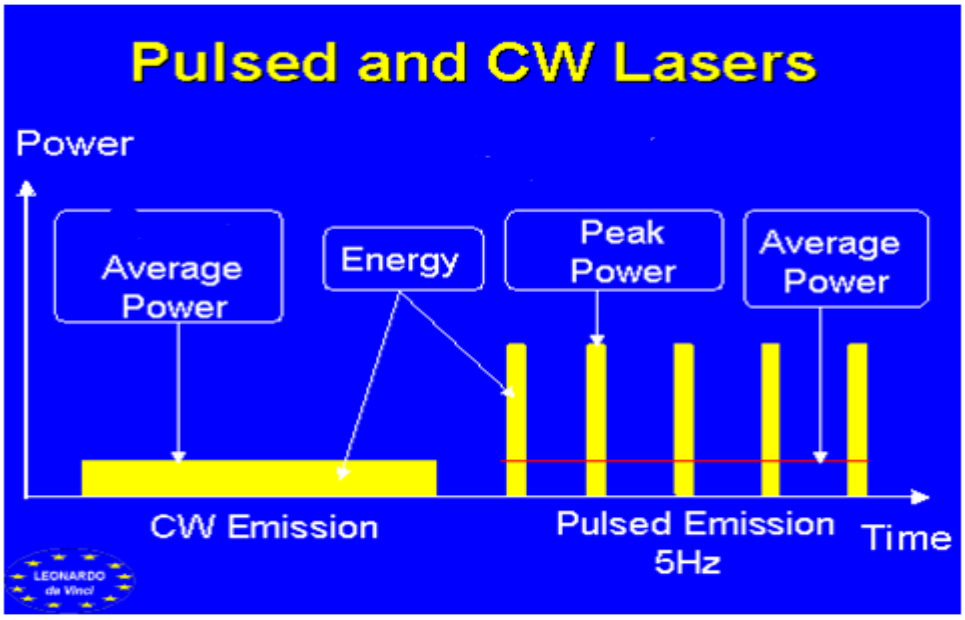


Figure (1-6) Laser beam modalities[27]

1.13 Laser tissue interactions

The variety of interaction mechanisms that may occur when applying laser light to biological tissue is manifold. Specific tissue characteristics as well as laser parameters contribute to this diversity. Most important among optical tissue properties are the coefficients of *reflection, absorption, and scattering*. Together, they determine the total transmission of the tissue at a certain wavelength. Thermal tissue properties – such as heat conduction and heat capacity – will be added. On the other hand, the following parameters are given by the laser radiation itself: wavelength, exposure time, applied energy, focal spot size, energy density, and power density. mainly five categories of interaction types are classified. [25] **Figure (1-7)**

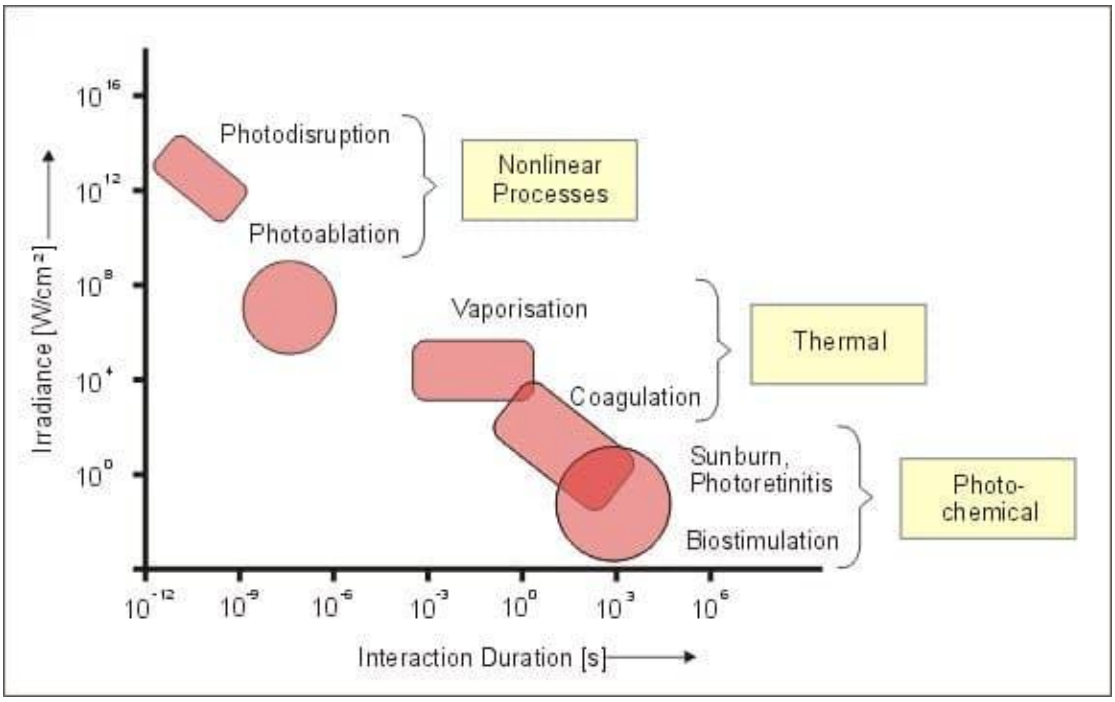


Figure (1-7) laser tissue interaction[23]

When laser is applied on a tissue, several processes can occur, the tissue can affect the laser light in some ways and also the laser light can affect the tissue.

FIRST: THE EFFECT OF THE TISSUE ON THE LASER LIGHT (Reflection, Refraction, Absorption & Scattering). [25]

Reflection: is defined as the returning of the electromagnetic radiation upon which it is incident. There are two types of reflections; the specular reflection,

seen in smooth surfaces (mirrors) where the surface irregularity is small compared to the wave length of radiation. The other is the diffuse reflection where the roughness of the reflecting surface is comparable or even larger than the wavelength of the radiation. [25]

***Refraction**: which occurs due to the change of the speed of light passing through two media with different refractive indices? Refractivity is varied by the nature of surface, wave length of the incident light and the temperature of the material. It increases with decreasing the roughness and lowering the temperature. [25]

**Absorption*: is defined as the attenuation of the intensity of light when it passes through a medium. Factors affecting absorption are; (1) the electronic constitution of the medium. (2) the wave length of the radiation. (3) the thickness of the absorbing layer. (4) Internal parameters; the temperature and the concentration of the absorbing agents. [25]

***Scattering**: is the basic origin of dispersion, her there is absorption and re-emission. If the frequency of the wave is not corresponding to the natural frequency of the particles, scattering occurs. The resulting oscillation is determined by forced vibration. If the frequency of the wave equals the natural frequency of free vibration of a particle, resonance frequency occurs being accompanied by a considerable amount of absorption. [25]

1.14 SECOND: THE EFFECT OF THE LASER ON THE TISSUE **Figure (1- 8)**

Five categories of interaction types are classified today. These are *photochemical linteractions, thermal interactions, photoablation, plasma-induced ablation,and photodisruption*. In particular, the physical principles governing these interactions are reviewed. Each type of interaction will be introduced by common macroscopic observations including typical experimental data and/or histology of tissue samples after laser exposure. [25]

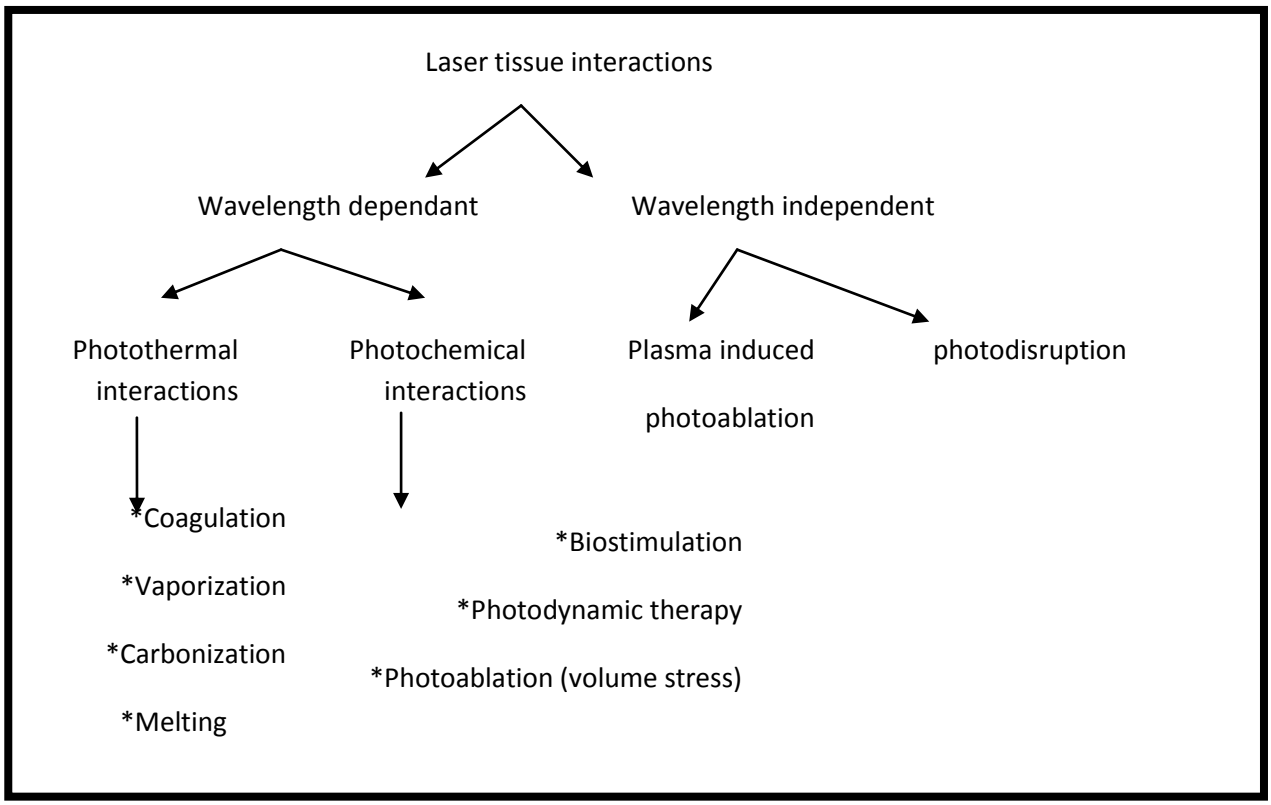


Figure (1-8) Laser tissue interactions

1.15 Photochemical Interactions

Photochemical interactions take place at very low power densities(typically 1W/cm2) and long exposure times ranging from seconds to continuous wave . Careful selection of laser parameters yields a radiation distribution inside the tissue that is determined by scattering. In most cases , wavelengths in the visible range are used because of their efficiency and their high optical penetration depths , photochemical interaction mechanisms play a significant role during biostimulation and photodynamic therapy (PDT). [25]

1.15.1 Biostimulation

Is believed to occur at very low irradiances with the potential effects of extremely low laser power (1-5 mW) on biological tissue .Wound healing and anti-inflammatory properties by red or near infrared light sources such as helium-neon lasers or diode lasers were reported. Typical energy 16fluencies ranged from 1-10 J/cm2. [25] Applications of biostimulation are:,Effect of laser on wound healing., Effect of laser on immune system ,Pain relief.

1.15.2 Photodynamic therapy (PDT)

Achromophore compound called photosensitizer which is capable of causing light induced reaction in non absorbing molecules when injected into the body and after the excitation by laser radiation the photosensitizer perform several simultaneous or sequential decays which result in intramolecular transfer reactions and at the end irreversible oxidation of cell structure result [25].

1.16 Photothermal interactions

The term thermal interaction stands for a large group of interaction types, where the increase in local temperature is the significant parameter change. Thermal effects can be induced by either CW or pulsed laser radiation. However, depending on the duration and peak value of the tissue temperature achieved, different effects like *coagulation, vaporization, carbonization* and *melting* may be distinguished.

Since the critical temperature for cell necrosis is determined by the exposure time, no well defined temperature can be declared which distinguishes reversible from irreversible effect. Thus exposure energy, exposure volume and exposure duration together determine the degree and extent of tissue damage. The location and spatial extent of each thermal effect depend on the locally achieved temperature during and after laser exposure. [25] **Figure (1-9).**

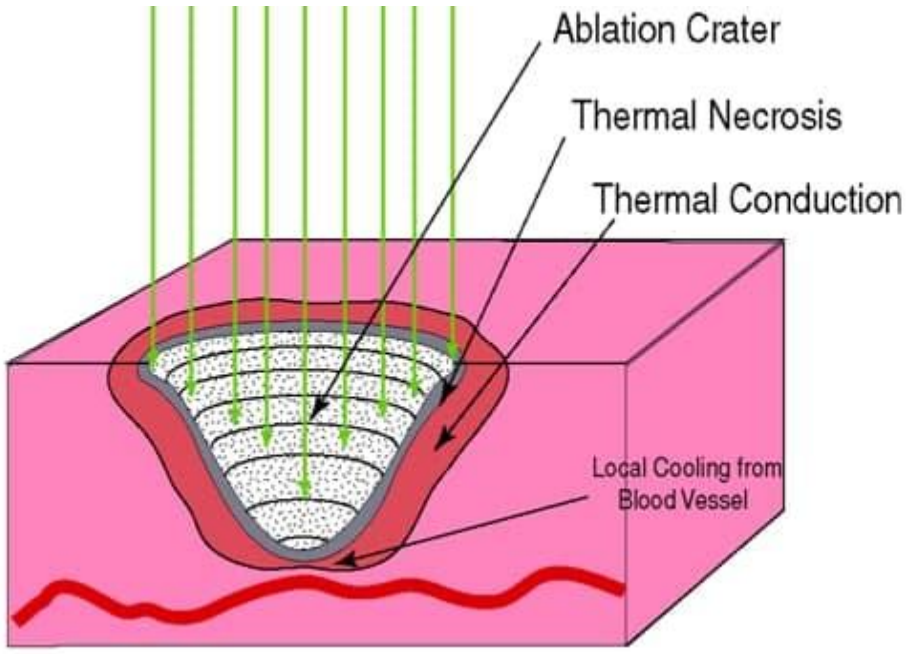


Figure (1-9) Location of thermal effects inside biological tissue[25]

1.17 Ablative Photodecomposition (Photoablation)

Photoablation occurs when material is decomposed when exposed to high intense ultraviolet laser irradiation. Typical threshold values are 10^7–10^8 W/cm^2 at laser pulse durations in the nanosecond range. The geometry of the ablation pattern itself is defined by the spatial parameters of the laser beam. The main advantages of this ablation technique lie in the precision, its excellent predictability, and the lack of thermal damage to adjacent tissue. Only when photons from ultraviolet laser (wavelength < 350 nm) are absorbed, the energy gain is usually high enough to access an electronic state which exceeds the bond energy dissociating chemical bonds at the very next vibration. Therefore, this interaction is limited to the application of ultraviolet light [25].

1.18 Plasma induced ablation

Optical break down can be induced when obtaining power densities exceeding 10^{11}W/cm^2 in solids and liquids. Ablation is obtained by ionizing plasma formation with an end result of very clean ablation associated with an audible report and bluish plasma sparking. Lasers with pulse duration of less than 500 ps can induce plasma formation. Power densities of up to 10^{13} W/cm^2 may be achieved. Lasers used are pulsed YAG family and Ti:Sapphier lasers. Its clinical application is typical in corneal surgery and caries therapy. [25]

1. 19 Photodisruption

In this type of interaction, in addition to plasma formation, shock wave is generated leading to cavitations and jet formation. This ends up with fragmentation and cutting of tissue by these mechanical forces. Pulse durations of more than 500 ps usually induce photodisruption. Power densities may reach up to 10^{16} W/cm^2 and again the Nd:YAG and Ti:Sappier lasers are used. Typical clinical applications are lens fragmentation and destruction of urinary and billiary stones (lithotripsy). [25]

1.20 Laser Safety

Laser safety is safe design, use and implementation of lasers to minimize the risk of laser accidents, especially those involving eye injuries. Since even relatively small amounts of laser can lead to permanent eye injuries, the sale and usage of lasers is typically subject to government regulations, Moderate and high-power lasers are potentially hazardous because they can burn the retina of the eye, or even the skin. To control the risk of injury, various specifications, for example ANSI Z136 in the US and IEC 60825 internationally, define "classes" of laser depending on their power and wavelength. These regulations also prescribe required safety measures, such as labeling lasers with specific warnings, and wearing laser safety goggles when operating lasers. [28]

1.20.1 **Laser radiation hazards and damage mechanism**

Laser radiation predominantly causes injury via thermal effects. Even moderately powered lasers can cause injury to the eye. High power lasers can also burn the skin. Some lasers are so powerful that even the diffuse reflection from a surface can be hazardous to the eye. [29]

The coherence, the low divergence angle of laser light and the focusing mechanism of the eye means that laser can be concentrated into an extremely small spot on the retina. A transient increase of only 10 °C can destroy retinal photoreceptor cells. If the laser is sufficiently powerful, permanent damage can occur within a fraction of a second, literally faster than the blink of an eye. Sufficiently powerful lasers in the visible to near infrared range (400-1400 nm) will penetrate the eyeball and may cause heating of the retina, whereas exposure to laser radiation with wavelengths less than 400 nm and greater than 1400 nm are largely absorbed by the cornea and lens, leading to the development of cataracts or burn injuries. [30]

Lasers can cause damage in biological tissues, both to the eye and to the skin, due to several mechanisms. Thermal damage, or burn, occurs when tissues are heated to the point where denaturation of proteins occurs. Another mechanism is photochemical damage, where light triggers chemical reactions in tissue. Photochemical damage occurs mostly with short-wavelength (blue) and ultra-violet light and can be accumulated over the course of hours. Laser pulses shorter than about 1 μs can cause a rapid rise in temperature, resulting in explosive boiling of water. The shock wave from the explosion can subsequently cause damage relatively far away from the point of impact. Ultra short pulses can also exhibit self-focusing in the transparent parts of the eye, leading to an increase of the damage potential compared to longer pulses with the same energy. [30]

The eye focuses visible and near-infrared light onto the retina. A laser beam can be focused to intensity on the retina which may be up to 200,000 times higher than at the point where the laser beam enters the eye. Most of the light is absorbed by melanin pigments in the pigment epithelium just behind the photoreceptors, and causes burns in the retina. Ultraviolet light with wavelengths shorter than 400 nm tends to be absorbed in the cornea and lens, where it can produce injuries at relatively low powers due to photochemical damage. Infrared light mainly causes thermal damage to the retina at near-infrared wavelengths and to more frontal parts of the eye at longer wavelengths. The **table (1-2)** below summarizes the various medical conditions to the eyes caused by lasers at different wavelengths. [29]

Table (1-2) Bio-effects of laser on the eye

SPECTRUM	LOCATION	EFFECT
UV-C (200-280 nm)	Cornea	Photokeratitis
UV-B (280-315 nm)	Cornea	Photokeratitis
UV-A (315-400 nm)	Lens	Cataract
Visible (400-780 nm)	Retina	Retinal injury*
IR-A (780-1400 nm)	Retina, Lens	Retinal burn, cataract
IR-B (1400-3000 nm)	Cornea, Lens	Corneal burn, cataract
IR-C (3000-1000000 nm)	Cornea	Corneal burn
* Retinal injury can be thermal, acoustic or photochemical.		

The skin is usually much less sensitive to laser light than the eye, but excessive exposure to ultraviolet light from any source (laser or non-laser) can cause short- and long-term effects similar to sunburn, while visible and infrared wavelengths are mainly harmful due to thermal damage. **Table (1-3).**

Table (1-3) Bio-effects of laser on the skin

SPECTRU	LOCATION
UV-C (200-280 nm)	Erythema, cancer, accelerated aging
UV-B (280-315 nm)	Erythema, increased pigmentation, cancer, accelerated aging
UV-A (315-400 nm)	Erythema, increased pigmentation, skin burn
Visible (400-780 nm)	Photosensitive reactions, skin burn
IR-A (780-1400 nm)	Skin burn
IR-B (1400-3000 nm)	Skin burn
IR-C (3000-1000000 nm)	Skin burn

1.21 Safety measures

1.21.1 General precautions

Many scientists involved with lasers agree on the following guidelines:

- Everyone who uses a laser should be aware of the risks. This awareness is not just a matter of time spent with lasers; to the contrary, long-term dealing with invisible risks (such as from infrared laser beams) tends to reduce risk awareness, rather than to sharpen it.[32]

- Optical experiments should be carried out on an optical table with all laser beams travelling in the horizontal plane only, and all beams should be stopped at the edges of the table. Users should never put their eyes at the level of the

horizontal plane where the beams are in case of reflected beams that leave the table.

- Watches and other jewelry that might enter the optical plane should not be allowed in the laboratory.

- Adequate eye protection should always be required for everyone in the room.
- High-intensity beams that can cause fire or skin damage (mainly from class 4 and ultraviolet lasers) and that are not frequently modified should be guided through tubes.

- Alignment of beams and optical components should be performed at a reduced beam power whenever possible.[33]

1.21.2 Safety guides of Eye protection

1- Natural eye protection or defense: when light strikes the eye, it stimulates the optical protective mechanism of the eye or what is called reflexes

A- Tearing reflex: helps to wash noxious material or effect and foreign body from surface of the eye. Also this helps to remove debris.

B- Blinking reflex (= 0.25s), enables the eyelids to limit exposure to most intense wavelengths of light.

C- Aversion reflex that includes closure of the eyelids and movement of the head away to avoid exposure to noxious bright light.

2- Artificial or external eye protection: by using protective eyewear that is designed for that specific wavelength and optical density .the selection of eyewear must be proper fit, comfort, and visual performance.[33]

1.21.3 Laser protective eyewear requirements:

1. Laser protective eyewear is to be available and worn in by all personnel within NHZ of class 3b and class 4 lasers where the exposures above the MPE can occur.

2. The optical density or what is called attenuation factor of the laser protective eyewear that should be specified by LSO.

3. All laser protective eyewear shall be clearly labeled with THE OPTICAL DENSITY and the wavelength for which protection is afforded.

4. Laser protective eyewear shall be inspected for damage prior to use.

5. Use of self-adhering laser safe eye shields on the patient's eye during the laser operation. Soft foam pads on the undersurface of the eye shields directly on the closed eyes of the patients.[34]

1.21.4 Laser goggles

The use of eye protection when operating lasers of classes 3B and 4 in a manner that may result in eye exposure in excess of the MPE is required in the workplace by the U.S. Occupational Safety and Health Administration.[33]

Protective eyewear in the form of spectacles or goggles with appropriately filtering optics can protect the eyes from the reflected or scattered laser light with a hazardous beam power, as well as from direct exposure to a laser beam. Eyewear must be selected for the specific type of laser, to block or attenuate in the appropriate wavelength range. For example, eyewear absorbing 532 nm typically has an orange appearance, transmitting wavelengths larger than 550 nm. Such eyewear would be useless as protection against a laser emitting at 800 nm. Furthermore, some lasers emit more than one wavelength of light, and this may be a particular problem with some less expensive frequency-doubled lasers, such as 532 nm "green laser pointers" which are commonly pumped by 808 nm infrared laser diodes, and also generate an intermediate 1064 nm laser beam which is used to produce the final 532 nm output. If the IR radiation is allowed into the beam, which happens in some green laser pointers, it will in general not be blocked by

regular red or orange colored protective eyewear designed for pure green or already IR-filtered beam. Special YAG laser and dual-frequency eyewear is available for work with frequency-doubled YAG and other IR lasers which have a visible beam, but it is more expensive, and IR-pumped green laser products do not always specify whether such extra protection is needed.[33]

Eyewear is rated for optical density (OD), which is the base-10 logarithm of the attenuation factor by which the optical filter reduces beam power. For example, eyewear with OD 3 will reduce the beam power in the specified wavelength range by a factor of 1,000. In addition to an optical density sufficient to reduce beam power to below the maximum permissible exposure laser eyewear used where direct beam exposure is possible should be able to withstand a direct hit from the laser beam without breaking. [32]

1.21.5 Safety guides of Skin protection [30]

If lasers having the potential of causing skin damage are being used, adequate precautions should be taken to protect the skin, such as:-

1. Protective clothing and face shields must be used.
2. Preoperative site should be protected by use of the least amount of power or energy required.
3. Avoid inflammable drapes as paper or plastics.
4. Avoid alcohol or must be dry before application.
5. Recommended cloth saturated with water around operative sites.
6. Wearing long sleeves and gloves made of appropriate fire-resistant material.
7. Laser resistant drapes for personnel.[30]

2.1 Patients, materials and Methods

A prospective study including 10 patients (all males) with symptomatic second and third degree haemorrhoids submitted to laser haemorrhoidectomy by diode 980 nm laser at private clinic under local anesthesia from the period between August 2020 to February 2021 . Patients ages ranged from (32-55) years old with mean 45.3 years.

Each patient was getting ready for the procedure after full explanation and discussion regarding the nature of the procedure, the possible advantages and disadvantages, and expected complications.

Preoperative evaluation: A case sheet was prepared to record all the necessary information. Medical and surgical histories were taken from the patients with clinical examination for each patient and underwent hematological investigation for virological infection and bleeding tendency.

2.1.1 Inclusive criteria:

All Patients with a second and third degree haemorrhoid included in this study.

2.1.2 Exclusion criteria:

Patients with first and fourth degree haemorrhoid , those with associated anal fissure , fistula, sever comorbid disease or immune compromised patients was excluded from our study.

2.2 Clinical assessment

Clinical records of all patients were reviewed. Data concerning patient's history included: age, symptoms (*bleeding, nodule, itching, pain and symptomatic prolaps*), previous surgery. Preoperative assessment included digital rectal examination and anoscopy for assessment of the degree of haemrrhoid and any internal haemorrhoid.

2.3 Case sheet Description

A case sheet was prepared to record all the necessary information. Medical and surgical histories were taken from the patients with clinical examination for each patient as displayed in the table (2.1).

Table (2.1) Case Sheet for the patient

University of Baghdad

Institute of laser for Postgraduate Studies

Patient Case Sheet .....Case No. ( )

Name: …….……Age:……Gender**.....**

Address…….Phone:……

Chief compliant:… ……..……...

Surgical history:……..……..

Medical history:…… ……..……..

Clinical assessment.

Grade of haemorrhoid**.....**

Number of column**.....**

Follow up Visits (***severity of Pain***, ***Bleeding***, ***urine retention*** , *and* ***infection***.

Three days**.....** One week**.....**

Two weeks……..... Four weeks ……..

Four weeks**Scale*	***Pain***	***Bleeding***	***Urine retention***	***Infection***
No	0	0	0	0
Mild	1	1	1	1
Moderate	2	2	2	2
Severe	3	3	3	3

Then we classify the patients according to the grad of haemorrhoid and the number of columns.

2.4 Safety measures

In the present work, the laser employed is class IV laser which includes any continuous wave laser device with power outputs above 500mW.These types of laser can cause damage to eye and skin with direct intrabeam exposure and from specular or diffuse reflections. All personnel were asked to wear protective glasses appropriate to diode laser to eliminate the risk of eye damage. These glasses are designed with special wavelength and optical density for 980nm diode laser. The patient goggles were completely shielded, doctor goggles were transparent.

The eyes of the patient were covered with mops of cotton or gauze plus eye wear, taking into consideration the elimination of any reflecting materials, metals and polished plastic in the laser room.

2.5 The Material :

The medical laser system and accessories :

2.5.1 .Laser Specification

The laser system used was a 980 nm diode laser. It essentially incorporate a class IV, diode laser emitting at a wavelength (near infrared), with a power output at laser aperture ranging from 0.5-12 watts. The (A.R.C. laser) is used manufactured in Germany. (Figure.2-1)

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Figure. (2.1) " A.R.C. laser " Surgical 980nm Diode laser

Laser Specification of A.R.C. 980nm Diode Laser listed in Table (2-1).

Table (2-1) Specification of A.R.C. 980nm Diode Laser

Model FOX	Diode laser
Wavelength	980 nm
Operation mode	Continuous wave(CW) or pulsed
Power transfer	Fiber 200 um,300um,400 um, 600 um With or without hand piece
Cooling	Internal forced air convection
power	12 watts max
weight	1.2 kg
Shot frequency	Single pulse 0.02 Hz to 5,000Hz
Pulse length	100 µs to 30 sec, CW
Laser class	4 Classification according to EN 608255-1:2007
Aiming beam	532nm green <1mW

2.6 The Method

Pre operative preparation:

Each patient was invited for the procedure after full explanation and discussion regarding the nature of the procedure, the possible advantages and disadvantages and complications expected.

2.7 Procedure

In left lateral position and after applying 10% of povidone iodine solution as an antiseptic, A 25 mL solution composed of 2% lidocaine without epinephrine diluted by 25 ml normal saline was administered through multiple injections in the skin around the anus and deep in four quadrants around the anal canal . After managing the local anesthesia the haemorrhoid was grasped by two arteries grasper, figure (2-2)

Figure (2-2) Haemorrhoid was grasped by artery grasper

a safety precaution were applied through the use of the goggles for the patient and surgeon. Prepare the suitable hand pies as shown in figure (2-3). The bare fiber should be at least 3mm longer than the end of the hand piece tip.

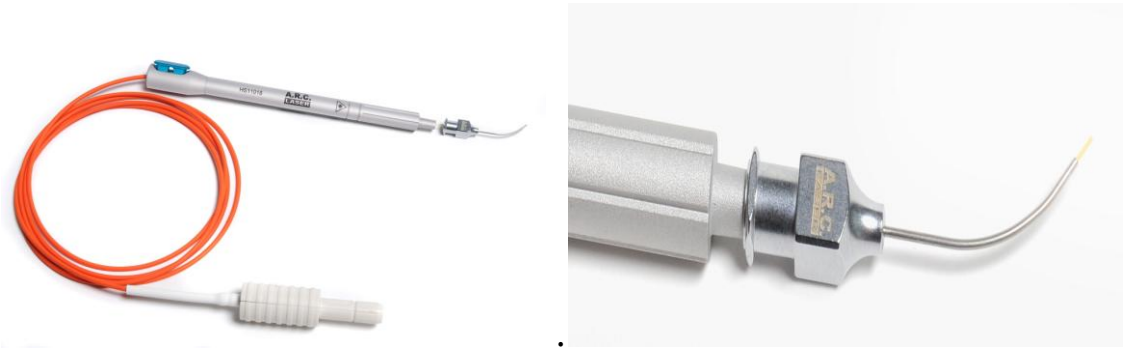

Figure (2-3) The length of bare fiber

2.8 Treatment Parameters and settings used in the study

With a continuous wave mode using contact method through fiber optic 300um as delivery system, diode laser on focus point start at (7W) then increasr to (9W) if necessary according to the thickness of skin, a longitudinal incision with the laser beam near the base of the haemorrhoid and continue the incision toward the base with power from (7-9W) then complete excision of the haemorrhoid. Figure (2-3) show complet exesion of two haemorrhoid(Aand B) thirdd egree,(C and D) second degree .

Figure(2-4) A,B

Figure (2-4) C,D

show complet exesion of two haemorrhoid (Aand B) third degree,
(C and D) second degree.

Patients were discharged with an anal packing soaked with xylocain gel pressing the site of surgery, which was removed 2 hours after the end of the procedure.

for each patient. Intraoperative and postoperative follow-up were recorded.

After the treatment, in case of pain patients were advised to take a pain killer like voltarin injection or oral non steriod, prophylactic antibiotic also given for three days injections and four days oral antibiotics.

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3.1 Results

The results of this study depend mainly on the clinical observation by inspection, patient complaints during operation, postoperation and clinical follow-up. All procedures were performed in an outpatient setting, All the procedures undergone under local anesthesia and most patient experience no pain during the operation apart from some burning during injection of anesthesia and All the patients tolerated the procedure and all of them were discharged home within one hour after treatment. In our study we have six patients with grade tow and four with grade three figure(3-1).

Table (3-1): Grades of haemorrhoids in 10 patients

Grade	No. of Patients	Percentage (%)
2nd degree	6	60%
3rd degree	4	40%
Total	10	100%

Four patients have three columns and six patients have two columns. Table(3-2)

. Table (3-2) .Number of columns in each patient

Number of columns	No. of Patients	Percentage (%)
3	(**2**patients) with 2nd degree And (**2**patients) with 3rd degree	40%
2	(**4**patients) with 2nd degree and (**2**patients) with 3rd degree	60%
1	zero	0%

For all (100%) patients there was a disappearance of the haemorrhoid. no one of them need a second session of laser treatment. There was no need for hospitalization, none of the patients encountered any significant intraoperative or postoperative complications. There was no recurrence detected during the follow up period which was 4 weeks after the laser haemorrhoidectomy.

3.2 Post-operative complications / follow up:

Patients were followed on the 3th and 7th Post-operative day, then 2weeks and 4weeks.

1- ***Pain*** was mild to moderate in 9 patients (90%) and sever in 1 patient (10%) who had 3rd degree with three columns of haemorrhoids, the pain in the first postoperative day and required injectable opioid analgesia (Tramal ampoule) for treatment, and then the pain decrease in the following days.

2- ***Bleeding***: No patient had significant primary bleeding. Mild reactionary bleeding occurred in 7 cases (70%), three of them with three columns and four of them with two columns of second and third haemorrhoids and manifested by soaked dressing and continues for three days postoperatively, and moderate bleeding in 3 cases (30%) one of them had 3rd degree with three columns of haemorrhoids and two of them with 2nd degree and two columns of haemorrhoids, the bleeding continue to the end of the first week and all of them was treated conservatively.

3- ***Infection***: Only 1 patient (10%) with second degree and two columns of haemorrhoid developed wound infection which required continuation of injectable antibiotics for seven days and daily wound care and good Hygiene.

4- ***Retention of urine***: one patient (10%), who had 3rd degree with three columns of haemorrhoids complaining from difficulty to urinate, and treated by analgesia and encouraging urination.

5- ***Anal stenosis***: non one of them suffered from anal stenosis.

6- ***Fecal incontinence***: non one of them suffered from ***fecal incontinence***.

7- ***Recurrence***: No recurrence found in the current study during the follow up period.

the result are listed in Table (3-3).

Table (3-3) The results of the patients

Post operative complications / follow up	**No. of Patients**	**Percentag (%)**	**Grade**	**Number of columns**
.No pain .Mild to Moderate	0 9	(0%) (90%)	.2nd and 3ed degree	.Tow and three
.Sever pain	1	(10%)	.3rd degree	.Three columns
Bleeding .Mild	7	(70%)	.second and third	.Three of them with three columns and four of them with two columns.
.Moderate	3	(30%)	.3rd degree	.Three columns
.Sever bleeding	0	(0%)		
Infection mild	1	(10%)	2rd degree	Tow columns
Mild Retention of urine Need catheterization	1 0	(10%) (0%)	3rd degree	Three columns
Anal stenosis	0	(0%)		
Fecal incontinence Mild ,Major	0 0	(0%) (0%)		
Recurrence	0	(0%)		

4.1 Discussion

All method for treatment of hemorrhoid has advantages, disadvantages, limitations and complications. Ferguson reported complications of conventional haemorrhoidectomy as pain 100%, recurrence 2%, retention of urine 15% .[37] Pain is the most common complication of hemorrhoidectomy.[35]

Since Milligan et al. described their open surgical technique; surgeons have disagreed about the best method to treat hemorrhoids. Surgical techniques have included rubber band ligation, stapling, infrared light, ultrasonic scalpel, conventional surgery, and laser therapy.
All aim to decrease pain and to improve healing in the postoperative period .[36]

In current study, only few of cases showed complication after treatment by diode 980 nm laser. mild to moderate pain (90%) sever in (10%), Mild bleeding occurred in 7 cases (70%) moderate in 3 cases(30%), infection in 1 patient (10%), retention of urine in 1 patient (10%), no anal stenosis (0%), no fecal incontinence, and recurrence rate is zero. Generally an uncomplicated haemorrhoidectomy is a satisfactory operation for both patient and surgeon. The findings of this study show that the treatment of hemorrhoids with diode laser results in much lower incidence of complications compared to the traditional excision and suture ligation methods of haemorrhoidectomy.

Postoperative pain is the most important complication that worries our patients and makes them reluctant to surgery. In current study diode 980nm laser haemorrhoidectomy post-operative pain was mild to moderate in 90% and sever in (10%) of cases only as compared with conventional haemorrhoidectomy where all patients have severe pain this had been found this is supported by another study carried out in London which suggested that CO2 laser haemorrhoidectomy is a safe procedure associated with reduced requirement for post-operative analgesics and cause no alteration in anorectal physiology[38], another study of the university of Sao Paolo, Brazil, they stated that CO2 laser haemorrhoidectomy had the advantages of being haemostatic, bactericidal, fast healing, does not affect neighboring structures, less postoperative complications as 94% of patients required no or simple post operative analgesic, only 1.4% needed narcotics, hemorrhage and stenosis were about 1%. [38] another comparative study by Wang et al. (Wang, et al., (1989)), which showed that 11% required narcotic analgesia in group A (CO2 laser haemorrhoidectomy) vs.56% in group B (conventional), urinary retention 7% in group A, 39% in group B. [39]

In a study by Giamundo et al, they concluded the haemorrhoid laser procedure was more effective than rubber band ligation in reducing complication and improving quality of life following treatment .[40]
Another study by lutfi G.Awazli 2014,in Baghdad carried on 25 patients showed No pain in (64%), mild to moderate pain (28%), severe in (8%), Mild Bleeding occurred in 3 cases (12%), infection: only 2 patients (8%), retention of urine: four patients (16 %), mild anal stenosis 3 patients (12 %), Mild temporal incontinence occurred in 2 patients (8%), and recurrence zero. It is concluded that CO2 laser haemorrhoidectomy is a safe and effective procedure associated with low incidence of post-operative complications.[41]
The unique thing in current study is that diode 980nm laser is used as a cutting and as a haemostatic tool at the same time in state of CO2 laser which is used usually in laser haemorrhoidectomy without using any suture materials which is commonly used by other studies, and also this study further corroborated the fact that laser haemorrhoidectomy, also the procedure done under local anesthesia and it is not only well tolerated but practicable and feasible in our locality where this concept has not been widely practiced. It is hoped that this work, though with a small number of patients may prompt more surgeons to offer local anesthesia to patients undergoing diode 980nm laser haemorrhoidectomy, as this may encourage early ambulation and subsequent discharge from the hospital. Follow-up duration was the main limitation in current study.

5.1 Conclusions

Diode 980nm laser haemorrhoidectomy is a safe and effective procedure associated with low incidence of post-operative complications but requires availability of instruments (Diode laser system) and skilled well trained surgeon.

Tissue cutting always needs high energy densities (high power or small spot size) At the cutting edges, beside the evaporation zones the tissue is always affected by the heat (coagulation). The advantage of laser use is can stop bleeding from cut vessels (haemostasis) and can tolerated by patients under local anesthesia.

5.2 Suggestions

1. Increase number of patients in future studies on 980nm diode laser for haemorrhoidectomy.

2. Increase the period of follow up to detect any recurrent rate.

3. Comparative study between 980nm diode laser, with other diode wave length(810, 940, 1064nm), and CO2 laser in haemorrhoidectomy.

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الخلاصه

الخلفية: البواسير هي واحدة من أكثر مشاكل الشرج الحميدة شيوعًا في جميع أنحاء العالم ، والتي تصيب أكثر من مليون شخص سنويًا. يمكن أن تصل نسبة الإصابة إلى ٣٦.٤٪. عندما تتسع هذه الأوردة فإنها تتحول إلى حالة مرضية تسمى مرض البواسير. يعزز الإجهاد احتقان هذه الأوردة ويسرع من تطور البواسير. الشكوى هي: نزيف ، عقدة ، تلف ، حكة ، ألم وتدلي. في معظم الحالات ، يتم علاج البواسير بشكل متحفظ ، ويتم الاتصال بالجراح عند فشل الإجراءات التحفظية ، أو حدوث مضاعفات مثل تجلط الدم. الاستئصال الجراحي للبواسير تم تمريره حتى الوقت الحاضر وهو أساس استئصال البواسير التقليدي ، وقد يحدث في هذا الإجراء ألم شديد ونزيف وعدوى وتضيق ورجوع البواسير. استئصال البواسير بالليزر هو أحد طرق العلاج البديلة الشائعة ، فهو يسمح بالتبخير أو استئصال البواسير ، كما أنه يغلق الأوعية الدموية الصغيرة ، كما أنه يغلق النهايات العصبية السطحية مما لا يمنح المريض أي إزعاج بعد الجراحة.. يمكن أن يقلل الاستخدام المناسب من فقدان الدم ، ويقلل من الانزعاج بعد العملية الجراحية ، ويقلل من فرصة إصابة الجرح ، ويعطي تليفًا وتضيقًا محدودًا.

الهدف من الدراسة: استخدام ليزر دايود ٩٨٠ نانومتر في استئصال البواسير من الدرجة الثانية والثالثة وتقييم الآثار الجانبية وتكرار الإصابة بالبواسير.

المرضى والمواد والطرق: دراسة استباقية تشمل ١٠ مرضى مصابين بأعراض البواسير من الدرجة الثانية والثالثة تم تقديمهم لاستئصال البواسير بالليزر بواسطة ليزر دايود ٩٨٠ نانومتر من الفترة ما بين أغسطس ٢٠٢٠ إلى فبراير ٢٠٢١. تراوحت أعمار المرضى بين (٣٢-٥٥) سنة بمتوسط ٤٥.٣ سنة. التقييم قبل الجراحة لتسجيل جميع المعلومات اللازمة. تم أخذ التاريخ الطبي والجراحي من المرضى مع الفحص السريري لكل مريض.

النتائج: معظم المرضى لا يعانون من أي ألم أثناء العملية باستثناء بعض الحرقة أثناء حقن التخدير وجميع المرضى يتحملون الإجراء. بالنسبة لجميع المرضى (١٠٠٪) كان هناك اختفاء للبواسير. لا أحد منهم بحاجة إلى جلسة ثانية من العلاج بالليزر.

لم يتم الكشف عن أي رجوع خلال فترة المتابعة التي كانت بعد ٤ أسابيع من استئصال البواسير بالليزر. كان الألم خفيفًا إلى متوسط في ٩ مرضى (٩٠٪) وشديد في ١ مريض (١٠٪) في اليوم الأول بعد الجراحة. لم يعاني أي مريض من نزيف أولي كبير.

أصيب ١ مريض فقط (١٠٪) بالتهاب في الجرح تطلبت استمرار تناول المضادات الحيوية لمدة سبعة أيام

شكى مريض واحد (١٠٪) من صعوبة في التبول ولم يعاني أي منهم من تضيق في الشرج ولا عدم سيطره على البراز

الخلاصة: أثبت التطبيق السريري لليزر دايود ٩٨٠ نانومتر في العمليات الجراحية أنه مفيد للممارسة اليومية ، ويمكن اعتباره عمليًا وفعالًا وسهل الاستخدام ويوفر بديلاً آمنًا ومقبولًا لتقنيات العلاج الجراحي التقليدية للبواسيرمن الدرجتين الثانية والثالثة.

بسم الله الرحمن الرحيم

وَإِذَا مَرِضْتُ فَهُوَ يَشْفِينِ

صدق اللَّهُ العظيم

سورة الشعراء:الايه***80***

وزارة التعليم العالي والبحث العلمي

جامعة بغداد

معهد الليزر للدراسات العليا

استخدام ٩٨٠ نانومتر دايود ليزر
لعلاج الدرجة الثانية والثالثة من البواسير

دراسة مقدمة إلى معهدِ الليزر للدراسات العليا - جامعة بغداد

كجزء من متطلبات نيل درجة دبلوم عالي

في تطبيقات الليزر في الطب / الجراحه العامه

مِن قِبل

مقدام محمد حمادي

زميل المجلس العراقي للاختصاصات الطبية

بكالوريوس طب وجراحة عامه

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الدكتور ضرغام نهاد محمد

بورد عراقي جراحه عامه. دبلوم عالي في تطبيقات الليزر في الطب / الجراحه العامه

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