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CO_2 Laser treatment of genital warts

A Dissertation Submitted to the Institute of Laser for Postgraduate Studies, University of Baghdad in Partial Fulfillment of the Requirements for the Degree of Higher Diploma in Laser in Medicine / Gynecology

BY

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بسم الله الرحمن الرحيم

((إِنَّا فَتَحْنَا لَكَ فَتْحًا مُّبِينًا (1) لِّيَغْفِرَ لَكَ اللَّهُ مَا تَقَدَّمَ مِن ذَنبِكَ وَمَا تَأَخَّرَ وَيُتِمَّ نِعْمَتَهُ عَلَيْكَ وَيَهْدِيَكَ صِرَاطًا مُّسْتَقِيمًا (2) وَيَنصُرَكَ اللَّهُ نَصْرًا عَزِيزًا (3)))

سورة الفتح

Acknowledgments

Thanks to ALLAH for giving me the ability to complete this work.

Dean of Institute of Laser for Postgraduate I would like to show my respect and thanks to **Dr Abdulhadi Al-Janabie** Studies \ University of Baghdad

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Great thanks to all the staff of Institute of Laser for Postgraduate Studies \ University of Baghdad.

Dedication

The price of success is hard work, dedication to the job at hand ,and the determination that whether we win or lose ,we have applied the best of ourselves to the task at hand.

I dedicate this work to all my family , for always believing in me.

Mayyadah

ABSTRACT

Background:

Genital warts are one of the most common types of sexual transmitted diseases. It is caused by infection with Human papilloma virus which is transmitted through sexual contact with infected partner . Carbon dioxide laser therapy is an efficient therapeutic modality because of its precision and rapid healing without scarring.

Objective:

Treatment of genital warts using CO_2 laser .

Patients and methods:

Ten female patients with genital warts were involved in this study . Their age range from 22-49 years treated by Co_2 laser at laser medicine research clinics of institute of laser for postgraduate studies from July 2017 to end of December , 2017. Application of topical lidocaine cream 10% for 30 minutes or local infiltration of 2% xylocaine had been performed .CO_2 laser in Chopped mode was used with a peak power :151 watts and repeated time 35 sec. in D mode, pulse duration 1.3 ms. Treatments by vaporization of the warts were done in one session except one patient with large number and multiple location two sessions were done .Three patients expressed mild pain during the procedure but it could be tolerated by them.NO edema or oozing observed during the first week. No post- operative infections or scars .One case of recurrence 1/10 ,(10%) after three months from treatment .

Conclusion:

CO_2 laser vaporization is an effective and safe method for treatment of genital warts and can be done in out- patient clinic.

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Abbreviations

CM	Centimeter
CO_2	Carbon dioxide
CW	Continuous Wave
DNA	Deoxyribonucleic acid
EGW	External genital wart
Er-YAG	Erbium-yttrium-aluminum-garnet
Fs	Femto second
HBV	Hepatitis B virus
HCV	Hepatitis B virus
HIV	Human immune deficiency virus
HPV	Human papilloma virus
IR	Infra-red
J	Joule
KTP	Potassium Titanyl Phosphate
KV	Kilovolt
Min	Minute
Mj	Millijaule
Mm	Millimeter
MPE	Maximum permissible exposure
MS	Millisecond
µs	Micro second
Nd-YAG	Neodymium :yttrium-aluminum-garnet
Nm	Nanometer
S	Second
STD	Sexual transmitted disease
T	Pulse duration
TCA	Trichloro acetic acid
TEM00	Transverse electromagnetic mode at 00
TRT	Thermal relaxation time
UV	Ultra violet
V	Volt
VDRL	Venereal disease research laboratory test
W	Watt

CHAPTER ONE

1-1 Introduction

Genital warts are one of the most common types of sexual transmitted diseases and also referred to as venereal warts or Condylomata Acuminate [(1).] Ano-genital warts are caused by Human papilloma virus which is transmitted through oral, anal and genital sexual contact with rare cases of Autoinoculation and vertical transmission have been reported.[(2)] HPV types are classified into high ,intermediate and low risk group .HPV type 16 and 18 are considered as a high risk group cancer associated HPVs ; while type 6 and 11 concerned as a low risk ;and HPV types 31,33and 35 have an intermediate association with cancer [(3).]

Genital HPV infection is closely linked to cancer of the cervix, glans penis, anus, vulvovaginal area, and periungual skin. Cancer occurs when there is integration of the HPV genome into the host DNA. In most persons, genital HPV infection appears to be transient, lasting about 1–2 years, and results in no sequelae. In a small proportion, about 2% of immunocompetent persons, infection persists, and in a small proportion of those with persistent HPV infection, cancer may develop [(4)].

Genital warts are sexually transmitted, therefore other STDs may be found in patients with genital warts. A complete history should be taken and the patient screened for other STDs. The whole genital area should be carefully examined because external genital wart (EGW) infection is often multifocal. Women with EGWs should have a routine cervical cytological screening to detect cervical dysplasia, but the presence of EGWs alone does not require more frequent Pap smears or gynecologic evaluation[(4)]. The primary goal of treatment of genital warts is to

eradicate or reduce the symptom. warts may recur after treatment because of activation of latent virus present in healthy skin adjacent to the lesion.[5] Several treatment options are developed for eradication of genital warts. Pharmacological therapy include topical application of podophyllin, podoflex ,5-fluorouracil and trichloroacetic acid(TCA) have had unsatisfactory results[6] [7] Local skin reaction and pain are common adverse effects. None of these drugs have been shown uniformly effective or directly antiviral.[5]

surgical techniques with the exception of cryosurgery, these modalities usually have the common advantage of complete treatment following one application. By electro-surgery removal of a very large mass of warts is a painful procedure, best performed with the patient under either general or spinal anesthesia. Pain after surgery is common. Carbon dioxide laser vaporization is typically used for treatment of refractory HPV disease or extensive warts of the anogenital-mucosal category and is particularly useful in the treatment of periurethral and vaginal warts. It is the treatment of choice for pregnant women with extensive lesions or lesions that do not respond to TCA.

Carbon dioxide laser therapy is an efficient therapeutic modality because of its precision and rapid healing without scarring. Pulsed-dye lasers [5] , diode lasers [8]and Holmium laser[9] have been used by some, with varying degrees of success.

1.1.1 Aim of the study:

Treatment of genital warts using CO_2 laser .

1.2 Genital warts

1.2.1 Incidence

Genital wart is the most common viral sexual transmitted disease . In fact its incidence is rising rapidly .It is approximated that 30%-50% of sexually active adult have HPV infection ,but only 1% to 2% of them have apparent genital wart. Most cervical dysplasia and cancer are associated with oncogenic HPV types[3].

1.2.2 Risk factors

- Early age of starting sexual relation .
- Number of sexual partner.
- Unprotected sex.
- Infection by other STD at the same time[10].
- Immunosuppression ,especially in patient infected with HIV.[11]

1.2.3 Pathogenesis

Infection with HPV cause development of epithelial changes.[12]Both cutaneous and mucosal epithelium are penetrated by viral particles, then invades basal keratinocytes of epidermis. Any site along genital tract the mucosa can be infected. Replication of the virus confined to the basal cell layer, and its life cycle linked to progressive differentiation of epithelial cells. The regions infected are distinct proliferation of viral DNA with formation of warty papule or plaque.

Histopathologically , the distinctive feature of infected cell is the development of morphologically atypical keratinocytes known as koilocytes which are enlarged cells with eccentric pyknotic nuclei .

The epidermis will exhibit apparent acanthosis with varying degrees of papillomatosis, hyperkeratosis ,and parakeratosis [13] and the dermis will often show an increase vascularization with presence of thrombosed capillaries .

Definitive diagnosis can be made by immuno-histochemical peroxidase-antiperoxidase stain and electron microscopy which enable direct visualization of viral particle within the cell.[14]

1.2.4 Regression and persistence

Infection with HPV are transient and tend to undergo natural regression .About 70%of women are HPV DNA undetectable at 12 months after infection detection ,while more than 80%are cleared at 18 months.

Latent HPV infection is controlled by cell mediated immunity which is also mediate the regression of HPV –induced lesions. Immunocompromised patient because of a decrease in cell mediated immunity are at increased risk of having and failing to eradicate HPV-related disease .This include organ transplant patients receive immunosuppressive drugs and patient with HIV-infection .

After wart eradication patient may continue to have latent virus in their anogenital epithelium and it is unknown whether HPV enough to allow transmission in this stage of development. The immune status has an impact on the course of the disease and to treatment response.[3]

1.2.5 Clinical feature

Genital wart are often asymptomatic but may cause discomfort ,discharge or bleeding. The typical lesion is soft, pink ,elongated ,and sometimes filiform or pedunculated. The lesions are usually multiple especially on moist surface and their growth can be accelerated with pregnancy.[15]Large malodorous masses may form on vulvar and perianal skin. This classical acuminate(sometimes called papillomatous,or hyperplastic) form constitutes about two thirds of ano-genital warts. The commonest sites the posterior fourchette correspond to the likely site of greater coital friction.[15] Most other lesions are flat and some of these generally on non-mucosal surface such as pubic skin, perianal skin and groin ,may be sufficiently pigmented.[16]figures (1-1 and 1-2)

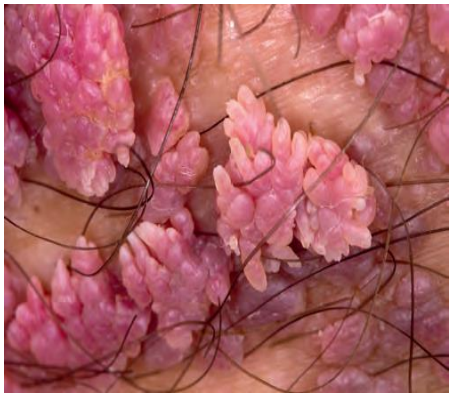


Figure 1-1Genital warts,anus Genital projections are large and numerous in warm moist areas . [3]

Figure 1-2 Numerous warts are present on vulva and vaginal area. [3]

1.2.6 Diagnosis

Even in women with confirmed cervical HPV infection, serologic tests are positive in only 50%, making serologic diagnosis of HPV infection of no use to the practicing clinician . EGW can be diagnosed by inspection. Bright lighting and magnification should be used during examining for HPV infection. Subclinical and latent are no longer

investigated because they are very common and no management strategy is known to eradicate these form of HPV infection . In patient with multiple recurrence ,acetic acid soaking may determine the extent of infection and helping to determine the area for application of topical therapies. The procedure is done by soaking the vagina and cervix with 3-5% acetic acid for about 10 min. GW turn white making them simply distinguishable.[4]

1.2.7 Differential diagnosis

-Seborrheic keratosis and anogenital intra epithelial neoplasia can produce warty lesions in the genital area .The development of large protuberant masses ,induration ,pain or serosanguinous discharge should rise the suspicion of malignant changes requiring biopsy . [17]

-Condylomata lata :appear as warty ,grayish-white plaques ,present in mucous membranes and may secrete fluid .[18]

-Molluscum contagiosum Appear as white ,flesh colored raised papule 1-5 mm or nodule 6-10mm.

-Valval papillomatosis With diffuse velvety or granular appearance in the vaginal introitus. [19]

1.2.8 Vaccination

Gardasil is a vaccine recommended in females and males (9 to 26) years of age for the prevention of cervical cancer, precancerous or dysplastic lesions, and GW caused by HPV types 6, 11, 16, and 18. Gardasil 9 protects against cancers caused by HPV types 16, 18, 31, 33, 45, and 58, and is used for prevention of GW caused by HPV types 6 and 11. It is administered intramuscularly in a three-doses regimen, with the

first injection followed by subsequent doses at months 2 and 6.Cervarix is a vaccine that protects against HPV types 16 and 18. [3]

1.2.9 Management of Sexual Partners

For management of genital warts examination of sexual partners is not necessary because the role of reinfection is probably minimal. Many sexual partners complain of apparent warts and may want treatment.. The larger number of partners are probably already sub clinically infected with HPV even if they do not have visible warts. The use of condoms may decrease transmission to partners likely to be uninfected, such as new partners. HPV infection may persist throughout a patient's lifetime in a dormant state and become infectious intermittently. Whether patients with subclinical HPV infection are as contagious as patients with exophytic warts is unknown. One study showed that the failure rate of treating women with Condylomata Acuminate did not decrease if their male sexual partners were treated.[3]

1.2.10 Clinical variants

mucosal HPV of low risk types responsible for ano-genital wart can cause disease at other mucosal surfaces .

Oral warts

including some which seems to have been sexually transmitted , usually contain HPV-6 or -11 and more rarely HPV-2, -57 or -16

Conjunctival papilloma

Human papillomavirus of the low-risk mucosal type is frequently detected in conjunctival papilloma with rare detection of high-risk types .

Respiratory papillomatosis

This condition is due most commonly to HPV-11, but also associated with other common genital types such as HPV-6 . Childhood cases are believed to result from maternal infection, probably at birth during vaginal delivery.(15)

Nasal inverting papilloma (synonym: inverted papilloma).

HPV-6/11, -16/18 and -57 have been demonstrated in nasal inverting papilloma and in an inverting papilloma of the maxillary sinus. (15)

1.2.11 Treatment

HPV cannot be completely eliminated because of the surrounding subclinical HPV infection. Removal of visible lesions decreases viral transmission. All treatment methods are associated with a high rate of recurrence that is likely related to surrounding subclinical infection.(3) Successful treatment requires accurate determination of the location and extent of involvement.(8)

1.2.11.1 Patient-Applied Therapies

1-**Imiquimod. 5% cream** . Imiquimod has an immunomodulatory effect and does not rely on physical destruction of the lesion. It has antiviral properties by induction of cytokines. Imiquimod enhances cell-mediated cytolytic activity against HPV. The cream is applied if tolerated, for a maximum of 16 weeks. Side effects are swelling, erythema erosions, weeping, crusting, scaling, itching, and burning. It may cause local hyper- or hypopigmentation. Warts clearance noticed by 8 to 10 weeks, or may be earlier**.(3)**

2- **Podofilox.** It is also known as podophyllotoxin, is the main cytotoxic ingredient of podophyllin.It arrests mitosis and result in

destruction of wart tissue within a few days, but can cause damage to surrounding skin . It is recommended that the total volume of podofilox should be limited to 0.5 ml per day. Treatment for a maximum of 4 to 6 weeks. About 15% of patients show severe local reactions to the treatment area after the first treatment cycle. Local adverse effects of the drug, such as pain, burning, inflammation and erosions have reported in more than 50% of patients.(3)

3- **Sinecatechins 15% ointment** is a botanical extract approved in 2006 by the United States Food and Drug Administration (FDA) for the treatment of genital warts. (20) The active ingredient is a green tea extract containing sinecatechins, which is thought to have anti-viral , anti-oxidant, and anti-tumor effect . Sinecatechins 15% cream is applied topically for up to four months.

1.2.11.2 Provider Administered Therapies

1- **Trichloroacetic acid** (TCA) 80–90% solution TCA is a chemically destructive acid that burns, cauterizes, the skin and mucosa. Several applications are required. The destructive nature of the product frequently extends beyond the superficial wart to encompass the underlying viral infection providing for clearance rates that have been
side effects of acid treatments include pain or burning during application as well as destruction of the healthy tissue surrounding the wart, but dermal injury or scarring is rare.(21)

2-**5-Fluorouracil Cream**. Application regarded in cases of genital warts that are resistant to all other treatments. Treat for several weeks. Irritation makes it intolerable for some patients.(3)

1.2.11.3 Surgical treatment

1-**Cryosurgery:** Liquid nitrogen is very effective for treating smaller,

flatter genital warts. It is too painful for patients with extensive disease. Warts on the vulva respond very well, with little or no scarring. Aggressive therapy causes pain, massive swelling, and scarring A blister appears and erodes to form an ulcer in 1 to 3 days, and the lesion heals in 1 to 2 weeks. Two to three sessions may be required .[3]

2- **Surgical removal and electro surgery**: Surgical Excision with scissors, curettage, or electro surgery induce immediate results. These methods are beneficial for both extensive condylomata and a small number of warts. Removal of a very large mass of warts is a painful procedure and is best performed under general or spinal anesthetic in the operating room.[22]

3-**Carbon Dioxide Laser:** The CO2 laser is a perfect method for treatment both primary and recurrent condylomata acuminate in men and women because of its high precision and the rapid healing without scarring. The laser can be used with an operating microscope to find and destroy the smallest warts. For pregnant women, this is the treatment of choice for extensive or large lesions and for cases that do not respond to repeated applications of trichloroacetic acid .[3]

HPV DNA can still be detected at the previous site of the warts. The CO2 laser has the advantage of being bloodless, but it is costlier and requires more technical skill to avoid complications..

Any surgical method that generates a smoke plume is potentially infectious to the surgeon. HPV DNA is detected in the plumes generated during CO2 laser or electrocoagulation treatment of genital warts. If these methods of wart treatment are used, an approved face mask should be worn, a smoke evacuator used at the surgical site during the procedure to remove the plume, and the equipment decontaminated after the surgery. [11]

1.3 Laser basic

The word LASER is actually an appreviation for Light Amplification by Stimulated Emission of Radiation.

Stimulated emission of radiation is a natural process first given by Einstein. It occurs by stimulation of the atoms of specially prepared medium when a beam of light passes through within that medium to emit light in exactly the same direction and wavelength as that of the original light beam.

A typical laser device (Figure 1-3)[23] consists of an

- gain medium for amplification.
- pumping source to supply energy into the device .
- optical cavity consist of mirror arrangement that reflects the beam of light back and forth through the gain medium for further amplification and a useful Laser beam is obtained by allowing a small portion of light to escape by passing through the partially transmitting mirror. [23]

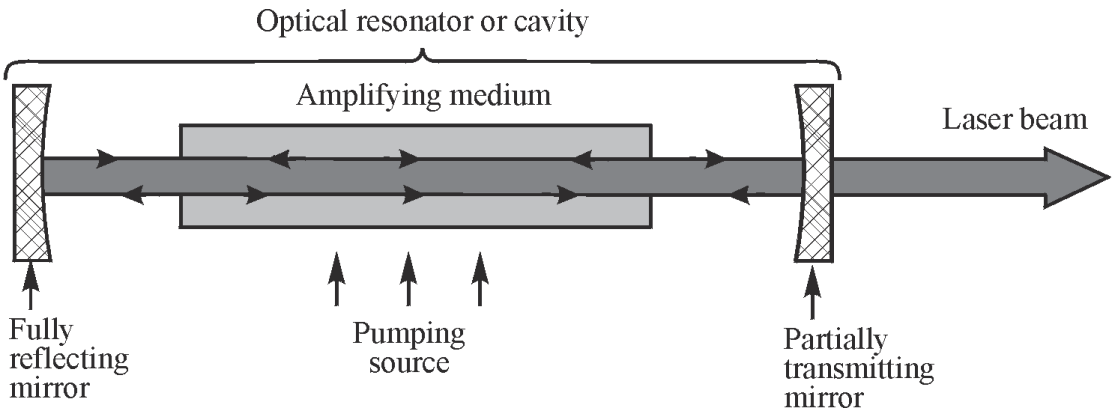


Figure 1-3 Schematic diagram showing the basic structure of a laser, including the basic components:
(1) a gain or amplifying medium, (2) an excitation mechanism or pumping source, and (3) the mirrors, which make up the optical cavity or optical resonator.[23]

1.3.1 LASER PROPERTIES

A. Collimation

the light waves are traveling in a specific direction and they are all parallel to each other[24].

B. Monochromaticity

refers to how pure in color (frequency or wavelength) the laser beam is or, in other words, how narrow the laser beam frequency bandwidth is.[24]

C. Coherence

refers to the how much the various portions of a single laser beam are in phase .

D. Intensity

Intensity or irradiance is the power of the laser beam divided by the cross-sectional area of the beam. It is given in watts per square centimeter (W/cm2). It is a measure of the amount of energy that can be applied to a specific area within a given amount of time. It is one of the two most important parameters in using the laser for laser surgery. The other important parameter is the wavelength of the laser , since the amount of absorption of all materials, including biological materials, is dependent upon the wavelength of the light.[24]

E. Focusability

Many applications of lasers involve their ability to be focused to a very small spots.[24]

1.3.2 Light and Matter

When a beam of light is incident on a slice of matter ,three effect take place which may interfere with its undisturbed propagation.[25]Figure 1-4

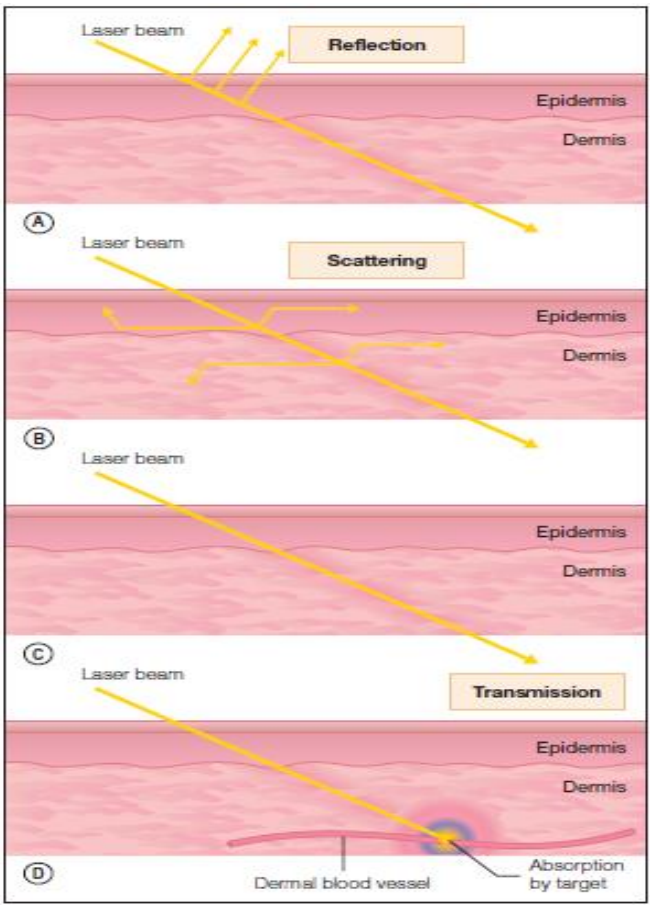


Figure 1.4 Laser interaction with skin[25]

Reflection

Is defined as the returning of electromagnetic radiation by surfaces upon which it is incident. In general, a reflecting surface is the physical boundary between two materials of different indices of refraction such as air and tissue. The simple law of reflection requires the wave of the incident and reflected beams and the normal of the reflecting surface to lie in one plane . [25] About 4-6% of the light gets reflected when it hits

the skin at angle 90°.The rate of reflection increases with an increase angle of incidence. [26]

Absorption

During absorption, the intensity of an incident electromagnetic wave is attenuated in passing through a medium ..Absorption is due to a partial conversion of light energy into heat motion or certain vibrations of molecules of the absorbing material.

In biological tissues, absorption is mainly caused by either water molecules or macromolecules such as proteins and pigments. Absorption in the IR region of the spectrum can be primarily attributed to water molecules, whereas proteins and pigments mainly absorbed in the UV and visible range of the spectrum. Proteins, in particular, have an absorption peak at approximately280nm according to Boulnois (1986).

When the light absorbed, the light energy is converted into heat. The heat generated by absorption produces the desired therapeutic effect in most cases of laser therapy . The target structures that absorb laser light are defined as chromophores, with the most common in the skin being water, hemoglobin, and melanin .[27]

The aim is to deliver a wavelength that is particularly absorbed by the chromophore, inducing heat buildup and the resultant destruction of that target. In an ideal situation, this wavelength would have little or no absorption by surrounding structures.

By controlling exposure times and energy delivered (fluence), the amount of heat buildup can be restricted to the desired target with minimal or no collateral damage to surrounding structures from heat dissipation, a property defined as thermal relaxation. A target's thermal relaxation time (TRT) is defined as the time required for the heated target tissue to dissipate half the absorbed heat and is related to the size and shape of

the target structure. Selective photothermolysis is achieved by ensuring that the laser pulse duration is equal to or less than the TRT of the target tissue. Thus, larger structures (e.g., hair follicles) have a longer TRT and are best treated with longer pulse widths. Smaller structures (e.g., melanosomes) have a shorter TRT and can be treated with much shorter pulse width .[28]

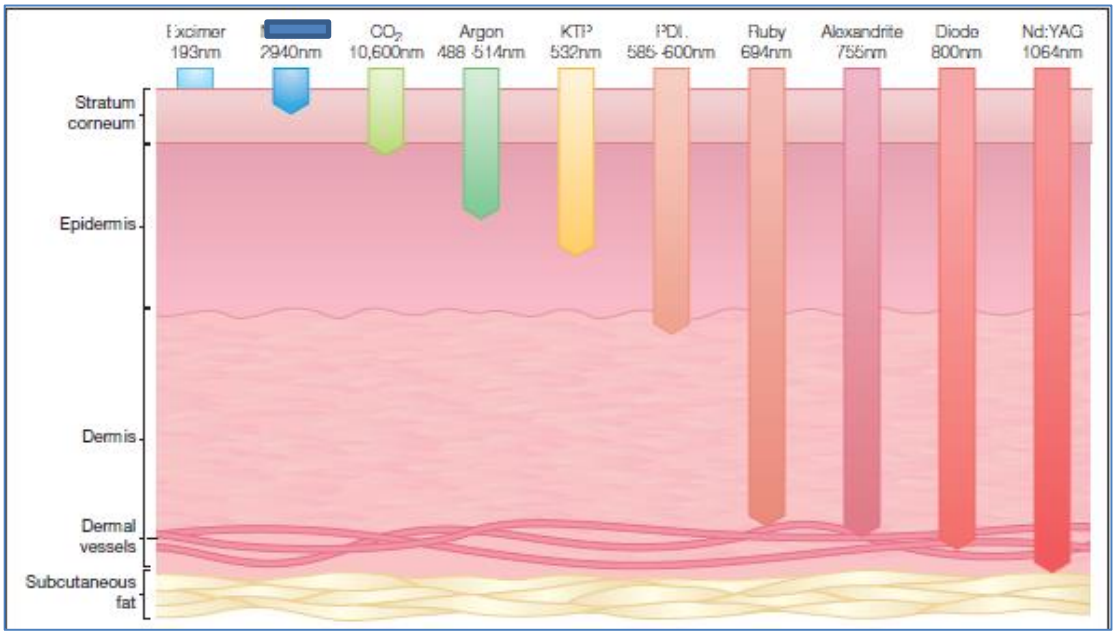


Figure 1.5 Laser penetration[28]

Scattering

The light can be scattered within the tissue when it has passed the stratum corneum .scattering mainly occur with shorter wavelengths largely in the dermis due to the counteraction Mechanisms collagen fibers and predominantly in the foreword direction . [29]

1.3.3 Interaction Mechanisms

When applying laser light to biological tissue several type of interaction mechanisms may occur due to specific tissue characteristics as well as laser parameters .Figure 1-6 and figure 1-7. [30]

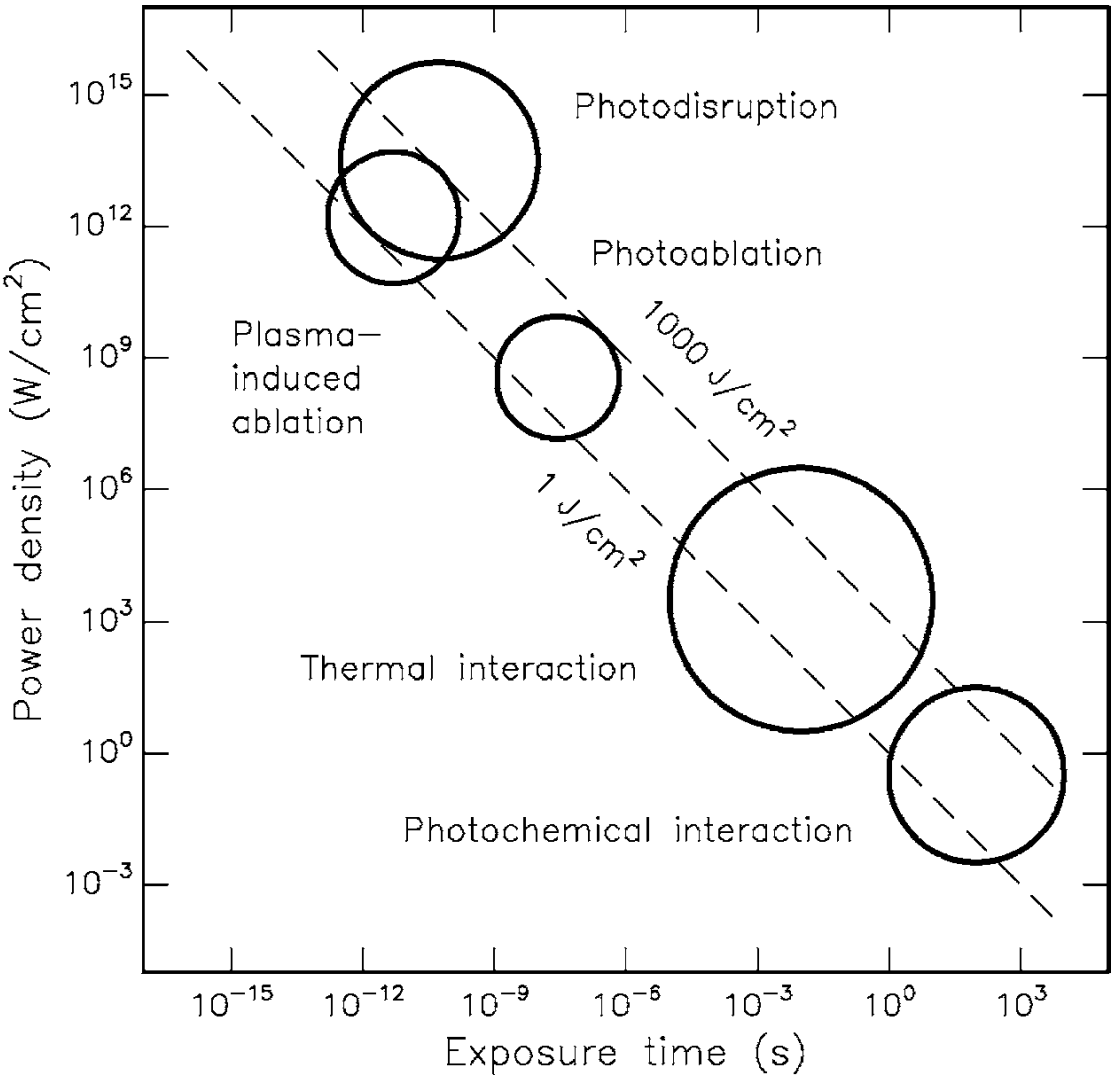


Figure 1.6 An overview of different types of laser –tissue interaction and irradiance and exposure duration at which they dominate.[30]

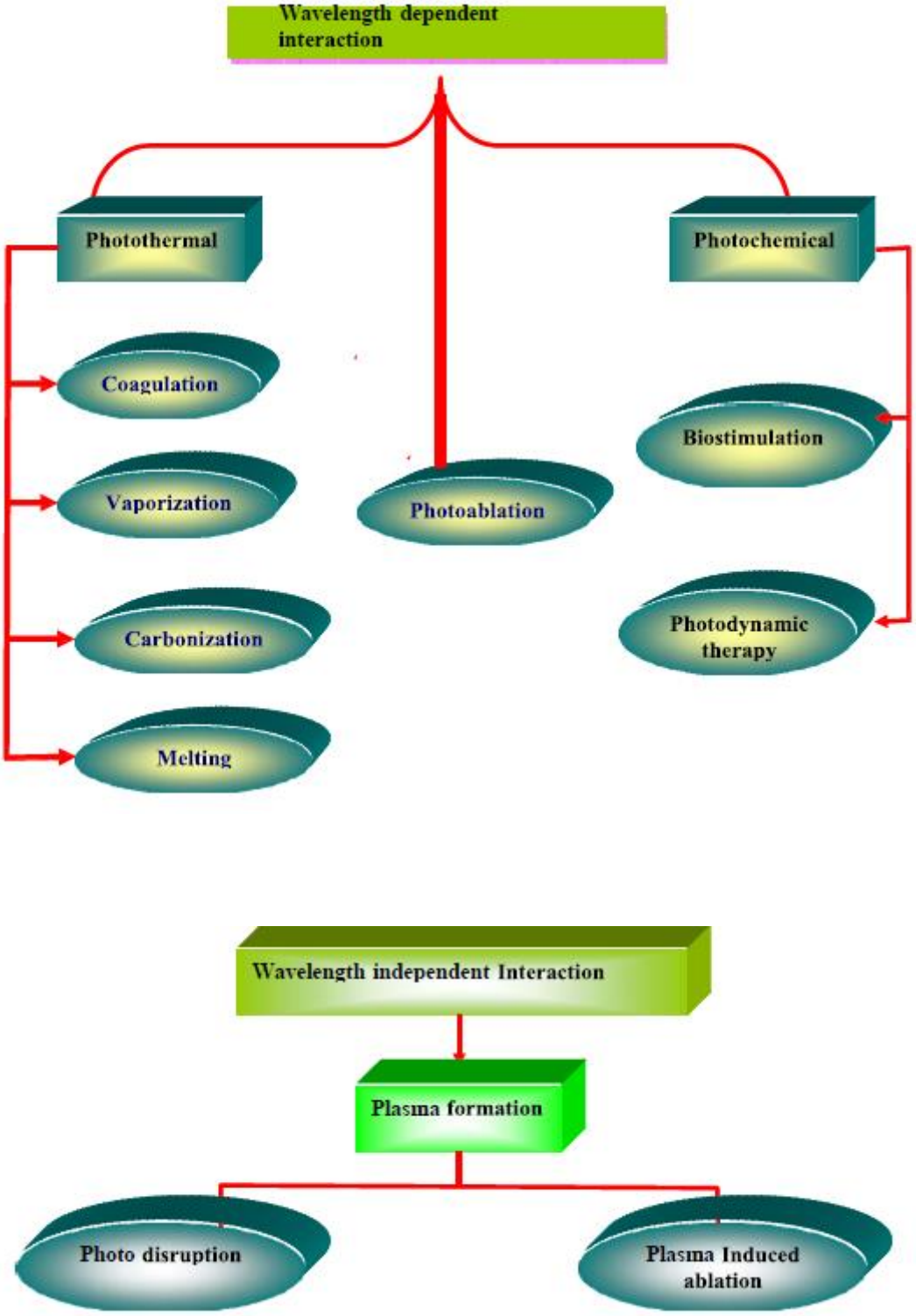


Figure (1. 7) Laser tissue interaction mechanisms[25]

1.3.3.1 Wavelength dependent

Thermal Interaction

The term thermal interaction represent a large group of interaction types. The significant parameter change is the increase in local temperature .

Thermal effects can be induced by either CW or pulsed laser radiation. When laser energy is converted into heat in the tissue, thermal diffusion begins. Diffusion of heat through the tissue depends on the thermal properties of the irradiated material. Different effects like coagulation, carbonization, vaporization and melting may be distinguished depending on the duration and peak value of the tissue temperature achieved. For thermal decomposition of tissues, it is important to adjust the duration of the laser pulse in order to minimize thermal damage to adjacent structures. For laser pulse durations $\tau<\tau$ thermal relaxation time , heat does not even diffuse to the distance given by the optical penetration depth L. for $\tau>\tau$ thermal relaxation time heat can diffuse to a multiple of the optical penetration depth, i.e., thermal damage of tissue adjacent to the decomposed volume is possible. [31]

The most important and significant tissue alterations are dependent on the temperature of the tissue after absorption of the laser radiation, as follow:

Table 1.1 thermal effect of laser radiation[31]

Temperature (°C)	Biological effect
37	Normal
<43	Biostimulation
43-45	Hyperthermia
50	Reduction in enzyme activity
60	Protein denaturation (coagulation)
70-80	Welding
80	Permeabilization of cell membranes
100°	Vaporization
>150	Carbonization
>300	Rapid cutting and ablation

Photochemical interaction

Photochemical interactions occurs at very low power densities (typically 1W/cm2) and long exposure times ranging from seconds to continuous wave. Careful selection of laser parameters produces a radiation distribution inside the tissue that is determined by scattering. In most cases, wavelengths in the visible range (e.g. Rhodamine dye lasers at 630 nm) are used because of their efficiency and their high optical penetration depths. The latter are of importance if deeper tissue structures are to be reached .

Summary of Photochemical Interaction

• Main idea: using a photosensitizer acting as catalyst
(only in photodynamic therapy)
• Observations: no macroscopic observations
• Typical lasers: red dye lasers, diode lasers
• Typical pulse durations: 1 s - CW
• Special applications: photodynamic therapy, biostimulation[25]

Photoablation

Meaning that material is decomposed when exposed to high intense laser irradiation. Typical threshold values are 10^7–10^8 W/cm2 at laser pulse duration in nanosecond range. The ablation depth, i.e. the depth of tissue removal per pulse, is determined by the pulse energy up to a certain saturation limit. The main advantages of this ablation technique lie in the precision of the etching process , its excellent predictability, and the lack of thermal damage to the adjacent tissue. The interaction with laser radiation is simulated by allowing each monomer unit to undergo excitation directly from an attractive to a repulsive state. This promotion

is associated with a change in volume occupied by each monomer, leading to a transfer of momentum and, thus, to the process of ablation.[25]

Summary of Photoablation

• *Main idea:*	direct breaking of molecular bonds by high-energy UV photons
• *Observations:*	very clean ablation, associated with audible report and visible fluorescence
• *Typical lasers:*	excimer lasers, e.g. ArF, KrF, XeCl, XeF
• *Typical pulse durations:*	10 ... 100 ns
• *Typical power densities:*	10^7 ... 10^{10} W/cm^2
• *Special applications:*	refractive corneal surgery

1.3.3.2 Wave length independent

Plasma-Induced Ablation

When the power densities exceeding 10^{11} W/cm^2 in solids and fluids – or exceeding 10^{14} W/cm^2 in air – a phenomenon called optical breakdown occurs . If several laser pulses are applied, a typical sparking noise at the repetition rate of the pulses is heard. By means of plasma-induced ablation, very clean and well-defined removal of tissue without evidence of thermal or mechanical damage can be achieved when choosing appropriate laser parameters.

Summary of Plasma-Induced Ablation

• Main idea: ablation by ionizing plasma formation.

• Observations: very clean ablation, associated with audible report and blueish plasma sparking.

• Typical lasers: Nd:YAG, Nd:YLF, Ti:Sapphire.

• Typical pulse durations: 100 fs - 500 ps.

• Typical power densities: 10^{11} – 10^{13} W/cm^2.

• Special applications: refractive corneal surgery, caries therapy.[25]

Photodistruption

The physical effects associated with optical breakdown are plasma formation and shock wave generation. If breakdown occurs inside soft tissues or fluids then cavitation and jet formation may additionally take place. The most important applications of photodistruptive interaction are posterior capsulotomy of the lens – and laser-induced lithotripsy of urinary calculi.

Summary of Photo disruption

• Main idea: fragmentation and cutting of tissue by mechanical forces

• Observations: plasma sparking, generation of shock waves, cavitation, jet formation

• Typical lasers: solid-state lasers, e.g. Nd:YAG, Nd:YLF ,Ti:Sapphire

• Typical pulse durations: 100 fs - 100 ns

• Typical power densities: $10^{11} – 10^{16}$ W/cm^2

• Special applications: lens fragmentation, lithotripsy [25]

1.3.4 laser in gynecology

The laser acts as a source of radiant power (or energy) in many surgical application, which is directed and focused on to tissue. The laser output is absorbed by the tissue, causing a localized temperature increase to a desired level. This temperature rise will result in 1) heating, and 2) vaporization and tissue removal. The lasers are named according to the material used for the lasing medium. They are classified by output power and wavelength. The output of these instruments may be delivered as a continuous wave , in a single pulse, or in a series of pulses. There are two parameters that determine the laser's effectiveness as a surgical tool. They are wavelength and the power-time characteristics. Wavelength of

the laser's emission and the spectral absorption characteristics of the tissue determine the percentage of the incident beam that will be absorbed by the tissue. The higher the absorption of the tissue to a particular wavelength, the more effective the laser as a surgical tool when used for producing an incision. determining the amount of tissue vaporization or coagulation. In a CW laser, the amplitude of the output beam is expressed in terms of power (watts) . An unfocused laser beam typically does not provide sufficient power density to cause the temperature rise desired for most biomedical applications. The beam diameter of an unfocused laser typically ranges from a few millimeters to two centimeters and is too large for many applications, including surgical incision and fiber optic coupling.[32)]

In gynecologic surgery, the laser can be attached to a surgical arm and hand piece, or to an operative microscope or colposcopy for micro-surgery. and properly used, it can destroy or excise an extremely small or extremely large area of tissue to any depth.

The cervix, vulva, and vagina appear to be useful models in demonstrating the expediency of the CO2 laser in the treatment of patients with neoplastic disease in an easy but effective way, when compared to more conventional methods.[(33)] Since the layers of damaged cells after laser treatment are often merely a few cells in width and depth, laser surgery represents the epitome of conservatism and has revolutionized the management of gynecologic disorders, including malignancies and pre-malignancies. It has the added benefit of the exclusive and precise removal of the diseased area, respecting and preserving the adjacent healthy tissue. [(33)]

In table (1-2) Six types of laser have been developed for medical application in gynecology. [33][34][35]

Table 1.2. Types of laser used in gynecology.[33,34,35]

Type	Wave length (nm)	Color	FIBER	Depth of penetration	Main application
CO2	10600	Infrared	No	0.1-0.5 mm	Cutting and vaporizing
Nd:YAG	1064	Infrared	Yes	3-4 mm	coagulation ,vaporization Excellent tool for hysteroscopic surgery because it is poorly absorbed by fluid
Argon	488/512	Blue-green	Yes	0.5 mm	Coagulation, selective absorption by hemoglobin excellent for treatment of endometriosis
KTP	532	Green	Yes	1-2 mm	Coagulation, selective absorption by hemoglobin excellent for treatment of endometriosis
Er:YAG	2940	Infrared	Yes	0.05 mm	for treatments of vaginal laxity, stress urinary incontinence, pelvic organ prolapse and vaginal atrophy.
Diode	800-980	Infrared	Yes	1-2cm	The 980nm generally indicated for excision, incision, vaporization, ablation, hemostasis, or coagulation of soft tissue.

1.3.5 CO_2 laser in gynecological surgery

CO_2 laser is a gas laser, which emits a wavelength of 10,600 nm in the infrared region of the electro- magnetic spectrum. The radiation that is produced is invisible. The lasing medium is actually a combination of helium (60 – 80%), nitrogen (~ 25%) and CO_2 (~ 5%), and the external energy source is usually either an electrical charge Such as from an electrical outlet, or a radio frequency field .

Because soft tissue is 80% water, and the CO_2 laser is strongly absorbed by water so deep penetration is prevented, as long as there is intra and extracellular water to be vaporized. Eventually , the penetration depth is determined by the water content of the target tissue, but is generally limited to 0.1 – 0.5 mm, with a lateral thermal damage of 0.5 mm .The greater the absorption ,the more precise and controllable the tissue destruction. If absorption is poor ,deep thermal effect will occur.[36]Since the epithelial cells have the greatest water content, absorption will be the greatest, and it is precisely this fact that make CO_2 laser an excellent tool for the treatment of external genital lesions. [37]

heat is delivered by the absorption of infrared beam emitted by the CO_2 laser, and used to elevate the temperature of the target tissue. At temperatures greater than 100 ° C, vaporization of the intracellular water occurs, with conversion of the cellular components to smoke. [36]

The CO_2 laser can be used for vaporization ,and excision or incision by increasing the power density.

The CO_2 laser is the standard laser in gynecology. Beside treating CIN, it is applied in vulvar intraepithelial neoplasia (VIN) and vaginal intraepithelial neoplasia (VAIN). Depending on the type of treatment, CO_2 lasers can be operated in three different modes – CW radiation, chopped pulse, and super pulse – as shown in Fig. 1-8 . Chopped pulses

with durations in the millisecond range are obtained from CW lasers when using rotating apertures.

Super pulses are achieved by modulation of the high voltage discharge. Thereby, pulse durations less than 1 ms can be generated. The peak power is inversely related to the pulse duration. The mean powers of CW radiation and chopped pulses are nearly the same, where as it decreases in the case of super pulses. Shorter pulse durations are associated with a reduction of thermal effects. Hence, by choosing an appropriate mode of the laser, the best surgical result can be obtained. [25]

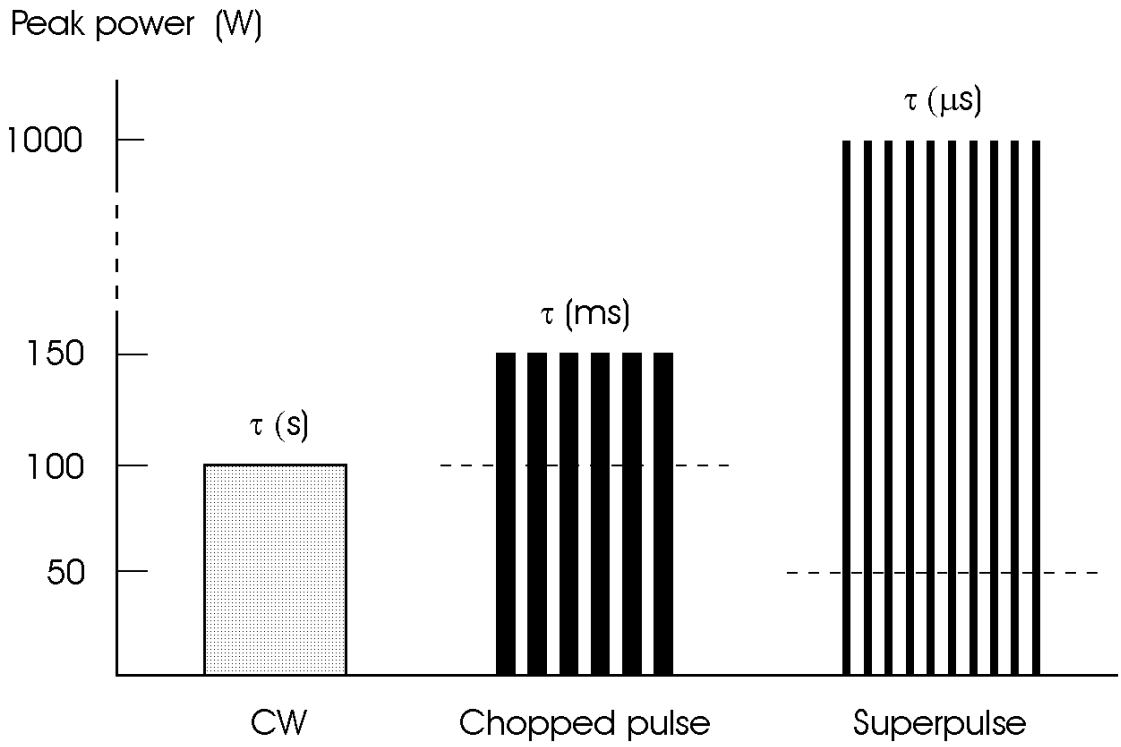


Figure 1.8 CW, chopped pulse, and super pulse modes of a CO_2 laser. Dashed lines denote mean power[25]

Carbon dioxide (CO_2) laser has been submitted to ablate the visible warts.[38] [39] CO_2 lasers wavelength (10600 nm) is absorbed by water

(primary chromophore for CO_2 laser). Alteration of radiant energy to heat directly rises the temperature of the skin water to more than 100 °C; hence , the tissue water vaporizes [38] The large vaporization heat of water is advantageous, since the vapor produced carries away extra heat and helps to prevent any further increase in the temperature of adjacent tissue. Due to the large increase in volume during this phase transition, gas bubbles are formed inducing mechanical ruptures and thermal decomposition of tissue fragments[25] so CO_2 laser ablates and vaporizes the skin wart until normal tissue architecture is seen.[39] . The spatial confinement of the laser light allows the exact tissue ablation leading to fast healing with little or no scar tissue.[12] Laser radiation acts thermally if the power densities ≥ 10W/cm2 are applied from either CW radiation or pulse durations exceeding approximately 1 μs . [25]

two important measures deserve to be highlight which is1- selection of an adequate power, and 2- surgical technique .It has been previously stated that laser vaporization of any particular lesion should always be accomplished by selection of the lowest possible average power, and that adjustments be made accordingly during the surgical procedure. The use of excessive wattage results in deep burns with subsequent increase in postoperative patient discomfort.

It must be remembered that the total mass ablated by a laser beam which strikes a target tissue in one fixed place is directly proportional to the total power of the beam, and to the time of application, and that the same factors apply to mass ablation of a moving laser beam, but vaporization will be somewhat less if total beam power and time of application are the same as for the stationery beam . Lasers, like any medical device must be used with skill and common sense. When confronted with multiple external condylomatous lesions, the perimeter should be established in order to be able to encompass all the abnormal areas within a specific

square surface. Do not vaporize condylomatous lesions whose total boundaries have not been identified. All the recurrences in this series have been outside the field of laser irradiation, suggesting that the new outbreaks were in fact at an incubating stage, not clinically apparent, or very small lesions missed during the vaporization process

Once the boundaries for the surface area to be treated have been established, the vertical-horizontal-oblique technique will assure an even, smooth removal of all lesions from surface to base. By operating the laser in this fashion, the heat conducted to the underlying tissue; distributed evenly along the surface of the lesion, resulting in minimal coagulation necrosis, the end result being a fine cosmetic result. Thus CO_2 laser therapy appears to be a safe and offers an alternative treatment modality for those recurring lesions frustrating patients .[37]

Advantages in Surgery with CO_2 Laser Application

- Reduced operative time.
- Reduced hospital stay.
- Minimal operative and postoperative complications.
- Reduced postoperative pain.
- Minimal adjacent tissue damage.
- Lymphatic and small blood vessels are sealed.
- Microscope-integrated system allows for precision micro cutting of tissues or exact vaporization of tumors.

1.3.6 Laser safety

The basic hazards from laser equipment can be classified into:

1-Laser Radiation Hazards

- Eye hazards: Corneal and retinal burns (or both), depending upon laser Wavelength
- Skin hazards

2-Non beam hazard

- Chemical Hazards
- Electrical Hazards

  Lethal electrical hazards may be present in all lasers, particularly in high power laser systems.
- Other Secondary Hazards, these include:
  - cryogenic coolant hazards,
  - excessive noise from very high energy lasers,
  - X radiation from faulty high-voltage (> 15 kV) power supplies,
  - explosions from faulty optical pumps and lamps,
  - fire hazards[25]
- Respiratory hazards when breathing laser-generated airborne contaminants (LGAC).[40]

1.3.6.1 LASER CLASSIFICATION

To give a basis for laser safety requirements, laser systems are classified according to the ANSI Z136.1 standard and the Federal Laser Products Performance Standard (FLPPS). The manufacturer is responsible for determining the laser classification. The builder must classify custom-

built and modified lasers. The ANSI Z136.1 standard is enforced by the Occupational Safety and Health Administration (OSHA). The Laser Products Performance Standard is enforced by the Centers for Devices and Radiological Health (CDRH), a part of the Food and Drug Administration (FDA)

The following table 1-3 describes the classification for continuous-wave lasers. The same hazard levels also apply to pulsed lasers with pulse duration of less than 0.25 seconds but classification is more complex.[41]

Table 1.3 classification of laser systems.[39]

Type	Description	Examples	Beam Hazard
Class 1	Completely enclosed or very low power (0.4 W for visible lasers)	CD player, laser printer	Incapable of causing injury during normal operation.
Class 1M	Completely enclosed or very low power (0.4 W for visible lasers)	Laser scanners, etchers	Incapable of causing injury unless collecting optics are used
Class 2	Visible lasers emitting less than 1mW radiant power	Some laser pointers	Visible lasers incapable of causing injury in .25 seconds.
Class 2M	Visible lasers emitting less than 1mW radiant power	Laser levels, survey equipment	Visible lasers incapable of causing injury in .25 seconds unless collecting optics are used.
Class 3R	1 to 5 mW	Most alignment lasers and laser pointers	Marginally unsafe for intrabeam viewing; up to 5 times the class 2 limit for visible lasers or 5 times the class 1 limit for invisible lasers.
Class 3B	Output power between 5 and 500 mW.	Analytical and research applications, embedded lasers	Eye hazard for intra beam viewing
Class 4	Above 500 mW	Surgical lasers, cutting, welding, research lasers	Eye and skin hazard for both direct and scattered exposure.

1.3.6.2 Damage mechanism

Lasers can cause injury to biological tissues, both to the eye and to the skin, due to several mechanisms.[42] When tissues are heated to the point where denaturation of proteins occurs, thermal damage or burn exist. 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 [43] .

Eye injury

The visible and near-infrared light focused by the eye onto the retina. A laser beam can be focused to an intensity on the retina which may be about 200,000 times more 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,[43] 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 below summarizes the various medical conditions caused by lasers at different wavelengths, not including injuries due to pulsed laser.[44]

Table 1.4 Various medical conditions caused by different laser wavelength.[44]

Wavelength range	Pathological effect
180–315 nm (UV-B, UV-C)	photokeratitis (inflammation of the cornea, equivalent to sunburn)
315–400 nm (UV-A)	photochemical cataract (clouding of the eye lens)
400–780 nm (visible)	photochemical damage to the retina, retinal burn
780–1400 nm (near-IR)	cataract, retinal burn
1.4–3.0 µm (IR)	aqueous flare (protein in the aqueous humour), cataract, corneal burn
3.0 µm–1 mm	corneal burn

Skin injury

The skin is usually much less sensitive to laser light than the eye. Skin injuries from lasers primarily fall into two categories: thermal injury (burns) from acute exposure to high power laser beams and photo chemically induced injury from chronic exposure to scattered ultraviolet laser radiation .

Thermal injuries may occur by direct contact with the beam or by specular reflections. These injuries are painful but usually not serious and are normally easy to prevent through right beam management and hazard awareness.

Photochemical injury can take place over time from exposure to the ultra violet by direct beam, specular reflections, or diffuse reflections. The effect can be minor or severe sunburn, and prolonged exposure may promote the formation of skin cancer. (41)

1.3.6.3 Possible Solutions

The American National Standard Institute (ANSI) Z136 series of laser safety standards covers lasers in medical settings and provides guidance for the safe use of lasers for diagnostic, cosmetic, preventative and therapeutic applications in healthcare facilities. These guidelines are include solutions such as:

-Use laser protective eyewear that give adequate protection against the specific laser wavelengths being used. All laser eyewear must be signalized with Optical Density (OD) and laser wavelength .

-Display warning signs conspicuously on all doors entering the Laser Treatment Controlled Area (LTCA), so as to warn those entering the area of laser use. Warning signs should be covered or removed when the laser is not in use .

-Maintenance on lasers and laser systems must be performed only by facility-authorized technicians trained in laser service .

-Provide local exhaust ventilation with a smoke evacuator or a suction system with an in-line filter to reduce laser-generated airborne contaminants (LGAC) levels in laser applications.

-Use skin protection if repeated exposures are anticipated at exposure levels at or near the applicable MPE limits for the skin barrier which decrease any transmitted laser radiation to levels below the Maximum that applicable.

-Use portable smoke evacuators and room suction systems with inline filters .

-Keep the smoke evacuator or room suction hose nozzle inlet within 2 inches of the surgical site to effectively capture airborne contaminants.

-Have a smoke evacuator available for every operating room where plume is generated.

-Evacuate all smoke, no matter how much is generated.

-Keep smoke evacuator "ON" (activated) at all times when airborne particles are produced during all surgical or other procedures. [42]

Chapter Two

Patients , material and method

2.1 Introduction:

This chapter includes the criteria of choosing the patients and description of the patients with description of the lesions of each patients ,also it includes the specification of CO_2 laser system used in the surgery ,the preparation of the patients ,the procedure of the surgery and the parameters used for the treatment.

This is a prospective study conducted from July to 30th of December 2017 at laser medicine research clinics in Institute of laser for postgraduate studies, University of Baghdad.

2.2 Patients:

Ten female patients with genital wart with age range from 22-49 years involved in this study . The patients recruited from my clinic. Patients provided informed signed consent before treatment.

Exclusion criteria:

-Immune compromised

-Diabetic patients

-pregnant women

2.3 Data collection

A full medical history was taken for each participant .For each we performed pelvic examination with inspection under magnification and good lightening .We performed speculum examination for each patient for any vaginal or cervical involvement. We recorded the age ,duration of appearance of wart ,number of lesion ,shape of lesion , size of largest

wart in mm, if the lesion primary or recurrent ,then we look for any complication and recurrence during the period of follow up.

2.3.1 Diagnosis

- The patients underwent physical examination in order to diagnose the genital lesion by visual inspection of characteristic skin lesion under magnification and lightening .

- Vaginal speculum examination performed to visualize all the vagina and the cervix for the presence of warts.

2.3.2 Investigation done :

-Serum for Anti HBV and HCV

-Serum for HIV

-VDRL test

-High vaginal swap for other STD .

One patient was positive for Trichomonas Vaginalis treated before surgery.

2.4 System specification:

CO_2 laser system manufactured by Daeshin Enterprise,model;DS-40U(B) (figures.2-1 and 2-2)

Figure 2-1:CO_2 laser system.

Figure 2.2 surgical hand Piece

Table 2.1 CO_2 laser system specification.

Laser type	CO_2 laser
Tube type	Sealed- off CO_2
Wavelength	10600nm,infrared
Divergence	≤ 3mrad
Mode structure	TEM00
Output Power	CW: 1-40W
	Pulse:1-40W
Repeat time	2ms-500ms (selectable)
Peak power	315W at 90ms
Aiming beam	Type:semi conductor diode laser 650nm,3.5mW .visible Beam diameter :2.5mm at source
Operating mode	Fractional scanning mode
	Ultra pulse mode
	Super pulse mode
Distance of the focus	F100 or F50
Size of the focus	O.1 mm at hand piece

Safety measures taken during the procedure:- The laser used in this study was class IV so the laser device was placed in isolated room with a door closed during the procedure .

-Vacuum system was used to extract the smoke and vapor plum .

-Special mask with filter used for the provider. Figure 2-3

Figure2-3 High filtration mask.

-Transparent goggle designed with special optical density suitable for the wavelength of CO2 laser.Figure 2-4

-Completely shield goggle for the patient.

Figure 2-4 Transperant goggle.

2.5 Procedure:

Patient were put in lithotomy position . Sterilization of the lesion with povidon-iodine solution .Application of topical lidocain cream 10% and in case of wide lesion and big size wart local infiltration of 2% xylocain had been performed. CO_2 laser in chopped mode was used with peak power 151 watts and repeat time 35 sec in D mode ,pulse duration 1.3ms. figure 2-5. Treatment was done by CO2 laser vaporization of the warts and residual debris wiped away with apeice of gauze .Vaporization of the whole lesion to the level of normal skin .Treatment were done in one cession except one patient with larg number and multiple location was treated in two cessions.

Figure 2-5 CO_2 laser parameter used in treatment.

Post operative treatment

-Washing the operative area with povidin solution three time per day for seven days.Area washed dried by electric hair drier on law heat.

-operated area treated by fucidin cream three times per day untill healing.

-separation of laser treated labia adhered to adjacent skin with clean finger.

-Nystacort cream to lesser the rubbing of healing skin.

-Abstinence from intercourse for four weeks,after that condom should be used for three months.

Follow up assessment of the patient: Patients were seen after 1,2,4 weeks then they were followed at 4 weeks interval for 8-22 weeks. Associated complication that may occure during the time of follow up like bleeding, oedema ,infection ,scaring ,hypopigmentation or hyperpigmentation ,they were looked for and recorded . Longer term complication like recurrence also evaluated.

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 (figure 2-6).

Ministry of Higher Education & Scientific Research
University of Baghdad
Institute of laser for Postgraduate Studies
Patient Case Sheet
Case No. ( )

Name		age	
Occupation		Gender	
Address		Marital status	
Phone/			
Complaint&durati0n			
History of present illness			
Past medical history		History of other STD	
Drugs	Oral contraceptive pills	Other drugs	
Smoking		Infected sexual partner	
Menstrual history			
Past Procedure and treatment			
History of precancerous or cancerous lesion:			

Pelvic examination and speculum examination: number of lesions:
Location: duration: shape:

Size of largest lesion:

Procedure:

Result within first week

Pain: edema: oozing:

Infection: pigmentation: healing: recurrence
Investigation: HIV VDRL: High vaginal swap for C&S cervical cytology

Figure (2-6) a case sheet for the patients.

Chapter three

3.1 Results

10 females patients were enrolled in this study .All were treated with CO_2 laser for genital wart .their ages ranging from 22-49 years .

The participants had a total of 138 lesions .This includes five patients had 20 lesions and more .

Lesions located in the perineum ,labia major ,labia minor ,mons pubis ,clitoris ,posterior forchette and the vagina .

The shape of the lesion was flat ,papules and cauliflower,or mixed shape .Reported duration of lesions was from 2 months to 5 years with two cases presented as recurrence after medical treatment .they had normal pap smear which they were performed previously .table 3-1 shows the patients data.

Table 3-1 Patients data.

No	Age years	Duration of lesions	NO OF Lesion	Location of lesions	Shape of the lesion	Size largest lesion	Notes
1	22	1 year	25	Perineum	Papule	5 mm	Recurrence
2	37	2 months	4	Posterior forchette ,perineum	Papule, Flat	4 mm	Primary lesion
3	38	2 months	3	Vagina	Flat	4 mm	Primary lesion
4	49	1 year	5	Labia majora , vagina	Flat	4 mm	Primary lesion
5	48	5 years	15	Perineum ,labia majora	flat	10 mm	Recurrence
6	27	5 months	20	Clitoris, labia major and minor, perineum,anus	Cauliflower, Flat	20 mm	Primary lesion
7	25	3 months	1	Perineum	Papule	6mm	Primary lesion
8	25	4 month	23	Perineum	Papule,cauliflower	10 mm	Primary lesion
9	32	2month	22	Perineum, posterior forchette,labia major ,labia minor	Papule	3mm	Primary lesion
10	22	4months	20	Mons pubis,clitoris,labia major ,labia minor, posterior forchette,anus	Flat, cauliflower	20mm	Primary lesion

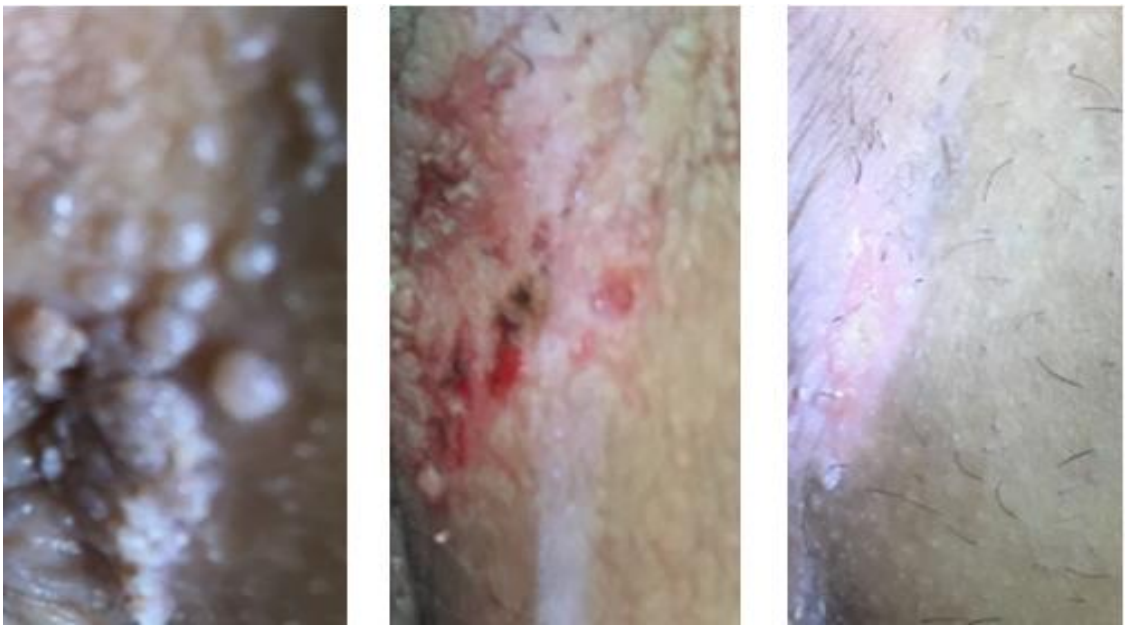
Treatment outcomes

Mild pain during the procedure expressed by three patients but they could tolerate it. No edema and no oozing observed during the first weak .Post-operative infection was not recorded in all the patients and healing was rapid . Time for follow up continued between 2-5 months during which no complication from the CO_2 vaporization were observed with no scars but with one case of recurrence after three months from treatment .

Figures 3-1, 3-2, 3-3 show examples from three cases with genital lesions before treatment, immediately after laser treatment and one or two weeks post laser treatment .

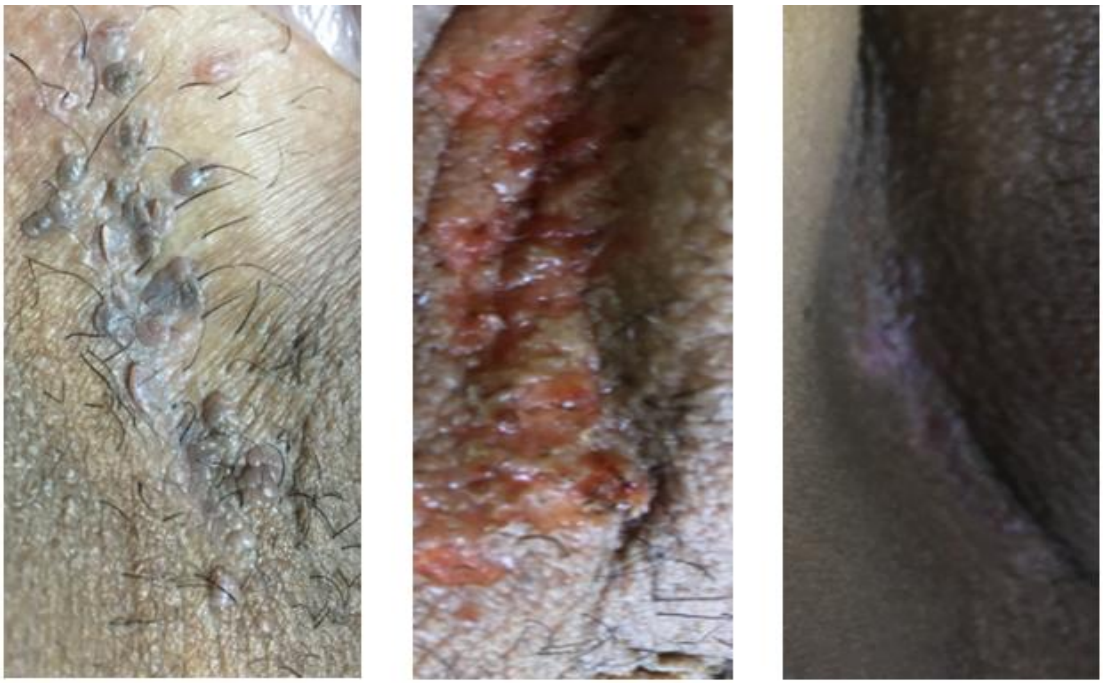
Before treatment | Immediately after treatment | Two weeks after treatment

Figure 3-1 22 years old female with warts, papule and flat in the labia major, labia minor, Mons pubis, clitoris and post forchette,20 lesions



Before treatment | Immediately after treatment | One week after treatment

Figure 3-2 25 years old female with 23 warts papule and coliflower in the perineum



Before treatment | Immediately after treatment | One week after treatment

Figure3-3 32 years old female with warts in the perineum,labia majora,posterior forchette,22 lesions

138 lesions were treated in this study with different sizes largest one up to 20 mm and the number of the lesion in each patient vary from single wart to 25 lesions with different shapes .

The location of the warts were in labia majora ,labia minora,mons pubis,clitoris,perineum, posterior forchette,vagina and anus.

Duration of lesion varies from 1 months up to 5 years .two patients presented as a recurrent cases treated by medical treatment with failure .one patient not response to medical treatment while the other seven patients were with primery lesions seak for laser therapy. The follow up period was 2-5 months ,and it is done by seeing the patients at interval of 1,2,and 4 weeks .After that follow up monthly by seeing the patients or by phone for the rest of the period of study .

Their was variation in follow up time for the patients because of time limitation for our research and certainly this effect the reported results of recurrence.

Regarding intra operative complication three patiens experience mild pain specialy in warts located at the anus,but every patient treated in this study could tolerate the pain caused by CO_2 laser treatment .

The operation was bloodless .No discomfort or edema was noticed immeditly nor one week post laser treatment . Infection not occurred in any patients in our study since the high tempreture of the laser beam result in evaporation of the virus , bacteria and fungi within the treatment field. There were no any long term complications in patients enrolled in this study except one case of recurrence of warts in area not envolved by the previous laser treatment .this patient with the recurrent warts did not use the condom after treatment .

3.3Discussion:

Human papilloma virus transmitted through sexual contact ,but there is also evidence of vertical and transmission through non –genital contact.[2]The ideal treatment is the one that could clear the lesion completely with aminimal amount of pain ,hypo or hyperpigmentation ,scars ,local and systemic adverse effects in addition to lower recurrence rate that are mostly achieved by physical ablative therapies(like CO_2 laser) compared to medication therapies.[45]

Our study show that the labia major and perineum are the most common location for developing the genital wart.Among our patients 3/10 (30%) had documented contact with infected sexual partners.

In this study lesions treated with CO_2 laser with single cession axcept one patient with 20 lesions and multiple location treated by two cessions at interval of four days.

In this study we sellected the lowest possible power out put to vaporize the tissue to a shallow depth of penetration for effective and safe treatment with minimal complications.We identified the total boundaries of the lesions then we started to vaporize and remove the lesions from the surface to the base.

CO_2 laser can vaporize warts ,so it is necessary to use high filtration masks and vacuum system for protection from the smake and vapor plum.

Compaired with medical therapy :topical application of podophyllin and 5-fluorouracil have had unsatisfying results[2].Local skin reactions and pain are common side effect of medical therapy and they can not be applied to the mucosal surfaces .Non of them are unifermly effective or

directely anti viral. [1]Long treatment courses with multiple cessions may be needed with medical therapy.

The principle advantage of CO_2 laser therapy are pricision ,probable elimination of infective agents and relatively cosmetic result.

Our study support the report of

LiXC , Zhonghua Yi Xue ZaZhi.2012 and Stefano Savoca, Luciano G Nardo ,Tiziana F.Rosano, Sebastiana D'Agosta, Filadilfo Nardo who found that CO_2 laser is effective and safe therapy for vulval condylomata acuminata [46,47]). Our study also support Ramirez, S.; Barrina, N.; Conell , Y.MC; Torres, P.; Leon,H.;Jimenez, P.; Acuna,D.; Meneses, M.who concluded that laser vaporization is an excellent alternative in treatment of lesion in vulva or vagina, also they concluded that laser vaporization versus excisional procedure there was advantages of cosmotic results of ablation treatment .[48]

Also in comparism with other surgical treatment M AzizJalal, GH Chaffarpenu, and B Mousa viford concluded in their research that CO_2 laser treatment of external genital wart was approximately two fold greater than cryo therapy and it was associated with lower recurrence rate. [49]

3.4 Conclusion

CO_2 laser vaporization have a low complication and side effect profile including post operative oozing ,pain and scarring ,also it is an effective and safe method for treatment of genital wart when used in chopped mode .It can be done in outpatient clinic with local anasthesia so can get ride from side effect of general anasthesia and post operative pain with the use of electrocautery which is widely used by gynecologists.

3.5 Future work

1- Increase the number of cases included in the study to verify a statistical analysis of the result.

2- Longer follow up period to assess the recurrence rate.

3- Include other laser types for comparison

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الخلاصة

الثآليل التناسلية هي واحدة من الأنواع الأكثر شيوعا من الأمراض المنقولة جنسيا. وسببه عدوى فيروس الورم الحليمي البشري الذي ينتقل عن طريق الاتصال الجنسي مع شريك مصاب.

الهدف الأساسي من علاج الثآليل التناسلية هو القضاء على الثآليل أو تقليل الأعراض. الثآليل قد تتكرر بعد العلاج بسبب تفعيل ا لفيروسات الكامنة الموجودة في الجلد الصحي المتاخمة للآفة عدة خيارات تطورت لعلاج الثآليل التناسلية، العلاج الدوائي وتشمل الاستعمال الموضعي لبودوفيلين، بودوفلكس، 5 فلوروراسيل وحمض ثلاثي كلورو اسيتيك أظهرت نتائج غير مرضية.

رد فعل جلدي موضعي والألم هي الآثار السلبية المشتركة. لم يظهر أي من هذه الأدوية فعالية مباشرة على الفيروسات. التقنيات الجراحية باستثناء جراحة التبريد cryotherapy، لها ميزة مشتركة هي العلاج الكامل بعد جلسة واحدة. الجراحة بالكي الكهربائي لأزالة كتلة كبيرة جدا من الثآليل هو إجراء مؤلم، ويفضل ان تتم تحت التخدير العام أو الشوكي . الألم بعد هذه الجراحة أمر شائع.

وعادة ما يستخدم التبخير بليزر ثنائي أوكسيد الكربون لعلاج مرض فيروس الورم الحليمي البشري أو الثآليل واسعة النطاق ومفيد بشكل خاص في علاج الثآليل المحيطة بالاحليل وفي المهبل. وهو العلاج المفضل للنساء الحوامل مع آفات واسعة .

العلاج بالليزر ثنائي أوكسيد الكربون هو وسيلة علاجية فعالة بسبب دقتها والالتئام السريع دون تندب. Pulsed Dye laser و Diode laser قد استخدمت من قبل البعض، مع درجات متفاوتة من النجاح.

الهدف من الدراسة

علاج الثآليل التناسلية بواسطة ليزر ثنائي أوكسيد الكاربون.

الطريقة والعمل

شاركت في هذه الدراسة عشر نساء مصابات بالثآليل التناسلية. تتراوح أعمارهم بين 22-49 سنة بمتوسط (35.5) عولجن بليزر CO_2 في عيادات الليزر الطبية البحثية بمعهد الليزر للدراسات العليا /جامعة بغداد للفترة من بداية ايلول 2017 إلى نهاية كانون الاول 2017.

تم أستخدام CO_2 ليزر 10600nmفي Chopped mode وقد تم العلاج عن طريق تبخير الثآليل في جلسة واحدة باستثناء مريضة واحدة مع عدد كبيرمن الثاليل وبمواقع متعددة تم علاجها في جلستين.

أعرب ثلاثة مرضى عن ألم خفيف أثناء الإجراء ولكن يمكن أن يكون مقبولا من قبلهم.لم تحدث اي وَذمة ولا ترشح دموي خلال الاسبوع الاول ولم تلاحظ أي عدوى ما بعد الجراحة ولا تضيق أو ندب.

حالة واحدة لظهور جديد للثالبل recurrence 10/1، (10٪) بعد ثلاثة أشهر من العلاج.

الاستنتاج:

المعالجة بليزر CO_2 هو وسيلة فعالة وآمنة لعلاج الثآليل التناسلية .

وزارة التعليم العالي والبحث العلمي

جامعة بغداد

معهد الليزر للدراسات العليا

معالجة الثآليل التناسلية بليزر ثنائي اوكسيد الكاربون

دراسة مقدمة الى

معهد الليزر للدراسات العليا /جامعة بغداد /كجزء من متطلبات نيل درجة

الدبلوم العالي في الليزر في الطب/ النسائية و التوليد

من قبل

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