

**Republic of Iraq  
Ministry of Higher Education  
& Scientific Research  
University of Al-Qadisiyah  
College of Veterinary Medicine**



## **The Laser In Surgery**

A Graduation Project Submitted to the Department Council of  
the Internal and Preventive Medicine-College of Veterinary  
Medicine/ University of Al-Qadisiyah in a partial fulfillment of  
the requirements for the Degree of Bachelor of Science in  
Veterinary Medicine and Surgery.

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

فَتَعَلَى اللَّهِ الْمَلِكُ الْحَقُّ وَلَا تَعْجَلْ بِالْقُرْآنِ مِنْ قَبْلِ أَنْ يُقْضَىٰ  
إِلَيْكَ وَحْيُهُ، وَقُلْ رَبِّ زِدْنِي عِلْمًا ﴿١١٤﴾

صَدَقَ اللَّهُ الْعَظِيمُ،

من سورة طه

## الاهداء

الى من بلغ الرسالة وادى الامانة النبراس الذي شع على  
الكون نورا والمبعوث رحمة للعالمين نبي الرحمة والانسانية  
الحبيب المصطفى سيدنا محمد (صلى الله عليه واله وسلم )

الى صاحب العصر والزمان الامام المهدي (عج)

الى ال بيت الرسول (عليهم السلام )

الى الشهيد اخي رحمه الله

الى شهداء العراق

الى من وقف بجانب امي وابي

الى من تشاركت معهم اجمل اللحظات اخوتي.....

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# **Certificate of Supervisor**

I certify that the project entitled (**-The Laser In Surgery--**)was prepared by **EmanJassim Mohammed** -under my supervision at the College of Veterinary Medicine / University of Al-Qadisiyah.

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2 / 6 / 2021

## **Certificate of Department**

We certify that EmanJassim Mohammed---has finished her Graduation Project entitled (**The laser in surgery**)and candidate it for debating.

Instructor

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-- / -- / 2021

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**Veterinary laser therapy is an innovative treatment that has gained popularity in recent years as veterinarians discover its benefits for pets. Used similarly to acupuncture, massage therapy, and other alternative therapies, laser treatment can be used in conjunction with or in place of medication to manage pain, inflammation, and wound healing.**



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# Chapter one

# **Introduction**

## **1.1 The laser**

Light amplification by stimulated emission radiation, or LASER, is an abbreviation for light amplification by stimulated emission radiation. In a nutshell, it's a machine that produces a beam of light energy with a certain wavelength. In the late 1980s, the first laser was developed, and its application in human surgery became common.

The CO2 laser is the most often used veterinary surgical laser. The CO2 laser's wavelength is absorbed by the water in skin and other soft tissue, causing the cells to vaporize and the tissues to be sliced. The surgeon may control how much of the laser beam is absorbed by the surrounding tissue, allowing for extremely precise surgery.

The interaction of laser light with tissue allows for a completely new surgical approach. A highly focused laser beam can efficiently ablate (vaporize or chip away) living tissue in laser surgery. It also seals (welds) capillaries, tiny blood vessels, lymphatics, and nerve endings at the same time, providing considerable benefits to both patients and surgeons. (4), (7)

# Chapter Two

## **LASER THERAPY**

The light emitted by a laser, which stands for light amplification by stimulated emission of radiation, can be absorbed by tissues, causing photothermal and photochemical reactions that have therapeutic value.

Low-level laser treatment (LLLT)<sup>1</sup> was first utilized for rehabilitative purposes, as opposed to high-power surgical lasers, which use heat to cause thermal destruction of cells and tissues. New therapeutic lasers with more power than LLLT but less power than surgical lasers have recently emerged.

The precise interaction between lasers and tissues in rehabilitation is unknown. Lasers, on the other hand, have been found to influence cellular activities. LLLT, for example, aids in the modulation of a variety of biologic processes that improve:

Muscle regeneration<sup>2</sup>

Wound healing

Joint healing<sup>3</sup>

Control of acute and chronic pain.

(8)

### **2.1.1 the most efficient soft-tissue surgical laser**

By using distinct types of lasers, Soft Tissue Laser Surgery differs from Hard Tissue Laser Surgery (bones and teeth in dentistry) and Laser Eye Surgery (eyesight correction operations). The wavelength of light produced by lasers differs from one another. The CO<sub>2</sub> laser is the most often used surgical laser in soft tissue surgery. Water in soft tissue absorbs the CO<sub>2</sub> laser wavelength (10.6 micrometers)

quite well. Since the 1960s, the CO<sub>2</sub> surgical laser has been the most efficient and dominant soft tissue surgical laser due to its excellent adaptability and precision. Laser surgery is frequently used in both human and veterinary medicine for a variety of purposes. Better hemostasis and visibility, reduced post-operative edema, and reduced post-operative pain are all advantages of laser surgery. Improved hemostasis and visibility will shorten overall surgery time in certain operations(2).

## **2.2 benefits of laser surgery**

When compared to standard stainless steel surgical scalpels, laser surgery has three primary advantages: less pain, reduced bleeding, improved tissue healing, and reduced inflammation.

Pain after surgery is lessened. When the laser closes the nerve terminals as it cuts, the discomfort is reduced. In the immediate post-operative period, this lowers pain impulses from the operation site. Also, because laser surgery causes less discomfort, the surgeon may be able to remove minor skin tumors with local anaesthetic rather than putting the cat under general anesthesia. Bleeding and blood loss are reduced. The laser beam vaporizes the tissues, cauterizing blood vessels and causing blood loss. Surgical Infection Risk is Reduced. The superheating of the tissues in the incision site kills any germs present at the time of operation, resulting in less infection. Inflammation is reduced. Because the laser beam is the only item that comes into contact with the tissue, it causes less

irritation and edema. Laser surgery allows your veterinarian to operate with more precision and can shorten the procedure time.

(3), (5)



# Chapter Three

### **3.1 General surgery procedures**

Perianal tumors, traumatic wound debridement Amputations, toe nail lasing, and tumor bed ablations are all options. Adenocarcinoma of the cerumen, Excision of the Vaginal Fold Chronic Chemodectoma, Mast cell tumors are a type of cancer that affects the mast cells. Debulking or excision of a colorectal tumor, debridement of a cranial cruciate ligament tear shaving of granulation tissue Cystotomy is a surgical procedure that removes the bladder. Everted sacculle resection, deep bulk removal Pulpotomy, or vital pulpotomy, is a surgical procedure that remove Fibrosarcoma is a type of fibrosarcoma. Infected wounds in the graft bed, Hepatic carcinoma – hepatic lobectomy, Hemangiopericytoma Resections of lipoma and liposarcoma, Operculectomy is a term that refers to the removal of a Revisions to perianal urethroscopy strictures, Rhabdomyxoma of the flank, pericardectomy Tendon sheath tumors, hemangiopericytoma, SCC, and infiltrating lipoma, complete prostatectomy Thyroidectomy, Enterotomy, Thyroidectomy, Thyroidectomy, Thyroidectomy, Thyroidectomy, Bladder transitional cell cancer, Perianal fistulas are a type of perianal fistula. The removal of a tumor or a mass, Resections of urethral prolapse Polyps in the urinary bladder, Excisions of vaginal tumors such as leiomyoma, SCC, and fibrosarcoma Anal saculectomy is a surgical procedure that removes the sacroiliac The carbon dioxide laser is an extremely successful instrument for treating perianal disorders. The perianal region's skin is delicate and thin. The carbon dioxide laser allows for a 'no-touch' way of removing these lesions, reducing postoperative pain and irritation. Controlling bleeding from arteries smaller than 0.5 mm with the carbon dioxide laser is highly successful. This is enough to stop most hemorrhages caused by the perianal region's abundant blood supply. Bacteria have infested the perianal area. Bacteria are photothermally vaporized by the carbon dioxide laser, resulting in a reduction in bacterial populations and a lower incidence of

postoperative infections. These elements aid the patient's recovery and allow them to return to work sooner. A carbon dioxide laser emits light with a wavelength of 10,600 nm, which is in the far-infrared spectrum. Water absorbs this wavelength of light very well, causing a heat effect. Because all soft tissues in the body are primarily made up of water, the carbon dioxide laser only enters the tissue extremely shallowly, causing very little thermal collateral damage. This interaction allows for delicate, controlled tissue dissection and makes the carbon dioxide laser a powerful instrument for incising, excising, and photoablating soft tissue. The features of the carbon dioxide laser follow the axiom of "what you see is what you get." Finally, as compared to other types of lasers, the carbon dioxide laser appears to have a lower learning curve. (5) ,(6)

### **3.1.1 Ophthalmology surgery procedures**

Treatment for conjunctivitis, Entropion, Meibomian Gland Excision, Gland Excision, Eyelid tumor removal, Hemangioma removal, Scleral corneal mass removal, Keratectomy, Mast cell tumors, Squamous cell carcinoma removal, Epiphora The CO2 laser can be used to vaporize eyelid masses, especially those that are close to the medial canthus and make scalpel excision and closure difficult; to treat diffuse eyelid papillomatosis; and to safely extend surgical margins after excision or debulking of neoplasms like fibrosarcoma and squamous cell carcinoma of the eyelid, limbus, or nictitans.

### **3.1.2 oral surgery procedures**

Oral mass amputation, Incisional Biopsy, Gingivectomy/plasty Aural Hematoma, Aural Hematoma, Aural Hematoma, Bulla curettage is a term used to describe a type of curettage Ablation of the ear canal Fixing a defective ear carriage, epulisremoval, epulisremoval, epulisre Gingival hyperplasia is a condition that affects the gums. Tissue beneath the tongue, Granuloma of the larynx, Laryngeal scar removal, Ventriculochordectomy Ear cropping, Stomatitis with lymphocytic plasmacytosis, Nasal Hyperkeratosis, Nasal Planum Resection, Nasal Hyperkeratosis Palate osteosarcoma, Polyps in the ear canal, Partial mandibulctomies, periodontal flap surgery, and partial maxillectomies are all examples of partial mandibulctomies. Sterilization and ablation for proliferative otitis Revision of the laryngeal web Ramulas, Ramulas, Ramulas Salivary mucoceles, salivary gland

removal, Squamous cell carcinoma, Soft palate excision Folds, stenotic nares Acanthomastous Epulis, Sublingual Sialocele Tonsillectomy, Tongue lesions Laryngeal saccules inverted, Troughing is used to make crown impressions. In oral surgery, carbon dioxide (CO<sub>2</sub>) lasers are utilized to accurately cut or vaporize soft tissue while maintaining hemostasis. CW lasers are CO<sub>2</sub> lasers designed for dental applications. The water content of oral tissues absorbs the CO<sub>2</sub> wavelength. When compared to other lasers, thermal necrosis zones of 100 to 300 μm at cut tissue edges are normal, giving superior oral structural safety. (Nd:YAG, argon, and diode), which can penetrate up to several millimeters. In contrast to the Nd:YAG laser, where no immediate observable change occurs in the tissue surrounding the vaporization zone, with the CO<sub>2</sub> laser, "what you see is what you get." It's difficult to gauge the true extent of thermal necrosis using the Nd:YAG laser. The advantage of using CO<sub>2</sub> laser ablation instead of standard excisional procedures is that the injured epithelium can be removed with as little as 0.1 to 0.2 mm of reversible thermal harm to the submucosa. Oral soft tissue treatments such as gingivectomy, gingivoplasty, frenectomy, and biopsy are performed with CO<sub>2</sub> lasers. Because of the direct absorption of this wavelength by water, tissue vaporization is more efficient with the CO<sub>2</sub> laser than with the other lasers listed...

### **3.1.3 Dermatology surgery procedures**

Ablation of acral lick granuloma Skin tags, follicular cysts, and tumors are examples of cutaneous masses. Epulis with gingival hyperplasia Digital pad hyperkeratosis/nasal planum hyperkeratosis Hemostasis is a term used to describe the state of being in a Melanoma, often known as malignant melanoma, is a type of cancer that Demodex, inclusion cysts, and papillomas are all symptoms of localized demodex. Pigmented viral plaques, Epibulbar melanoma Actinic keratosis is a type of keratosis that affects the skin. Pinna tumors are a type of

tumor that develops in the pinna Ceruminouscystomatosis in cats, Calcinosis circumscripta, Calcinosis circumscripta, Calcinosis circumscripta, Cal Removal of squamous cell carcinoma Papillomas virales, Management of wounds (acute and chronic), Plasma cell pododermatitis, Nodular sebaceous hyperplasia. hyperplasia is a condition in which a person's Because of its capacity to limit the zones of damage to microsurgery with little to no collateral damage, the CO2 laser has proven to be a good choice for laser surgery. This is the most common laser used in veterinary dermatology today. The device can be used in three different ways by the operator: skin incision, lesion excision, and ablation. It can be utilized for microsurgery or ablating bigger lesions and is easily controlled. . Because of its high water absorption, when used properly, this laser causes little to no collateral tissue damage....the ability for the operator to control the effect of the laser beam essentially to the area that you can see with no collateral damage has led to the widespread use of this laser in many areas of medicine, including veterinary dermatology...(5)

### **3.1.4 Avian and exotic surgery procedures**

Traumatic wound debridement, The removal of a polyp from the eyelid is known as an eyelid polypectomy. Tendon stripping is a surgery in which tendons are removed. Getting rid of avian pox lesions The diptheroid's membrane is obstructive. the anal sac is removed Egress of the choana, Fibrosarcoma is removed. Surgical removal of the vocal folds, Granulation tissue ablation Xanthoma removal, forepaw histiocytoma Lipoma removal is the surgical excision of a tumor from the liver. A gonadectomy is a surgical surgery in which the gonad is removed. Adrenal gland ectomy is a surgical surgery in which the adrenal glands are removed. Constricted toe syndrome is a condition in which the toes of a person are restricted. Ovary ablation is a procedure in which the ovaries are removed.

A papilloma removal procedure entails removing a papilloma via Caesarean section, for example. Adenocarcinoma of the kidneys is a kind of cancer that affects the kidneys. Incisions in the skin, Adenomas of the sebaceous glands Canthoplasty is a treatment that improves the appearance of the eyelids. A kind of cancer that affects the joints is synovial cell sarcoma. You say, 'Bumblefoot.' A nasal polyp ectomy is a treatment that involves the removal of a polyp from a uterine adenocarcinoma. The CO2 laser has numerous advantages in exotic animal practice. Only your creativity is the limit to what you may do with them... Reduced blood loss, pain, surgical time, and healing time are all advantages of using a carbon dioxide (CO2) laser in exotics. Because the CO2 laser shuts small capillaries as it cuts, there is less blood loss, which is advantageous because many alien species are small and so have limited blood volumes. CO2 lasers reduce pain during surgery by sealing nerve endings as they cut, which may help reduce self-inflicted harm after surgery. Reduced discomfort may also help to reduce post-surgery worry and anxiety. Lasers make surgery less risky and allow for a faster recovery time. The ablation of cutaneous masses is made easier with less blood loss. A capsule forms around an abscess in many exotics. There is a substantial recurrence rate if this capsule is not removed or is only partially eliminated. The capsule can be ablation using the CO2 laser.

### **3.1.5 Equine surgery procedures**

Sarcoid removal, Acute Scrotal Hernia Repair, Fibroma/Neurofibroma, Umbilical Hernia Repair, Sarcoid Removal, Sarcoid Removal, Sarcoid Removal, Sarcoid Removal, Sarcoid Removal, Sarcoid Removal, Sarcoid Removal, Sarcoid Removal, Sarcoi Mastocytoma of the Basal Cells, Procedure for an entrapped epiglottis, Removal of granulation tissue Polyps of lymphoid tissue, Castration, Cryptorchidectomy, Melanoma, Palmer digital neurectomy, Melanoma, Melanoma, Melanoma,

Melanoma, Melanoma, Melanoma, Melanoma, Melanoma, Resection of the scirrhous chord Squamous Cell Carcinoma, Neoplasia Membrane of the gastrointestinal pouch ablation, Ablation of penile and cervical lesions, Ethmoid hematoma Flesh with pride. Surgical lasers have increased operating precision, range, and decreased morbidity... Upper airway surgery in horses has also been transformed, and there are undoubtedly many more applications to come..(9)

## **Chapter Four**



## **4.1 Laser Therapy For Dogs**

Veterinary laser therapy is a non-invasive, pain-free, surgery-free, and drug-free treatment that can be used in conjunction with other treatments to address a number of illnesses. Deep-penetrating light is used in laser treatment for dogs to initiate a series of chemical reactions known as photobiostimulation. This mechanism helps to reduce pain by releasing endorphins, and it also stimulates wounded cells to repair faster. Although your dog's condition will determine how often and how long laser therapy is required, improvement is generally visible following the first appointment. Treatments last anywhere from 3 to 8 minutes, depending on the location. Because laser treatments for dogs are cumulative, each treatment helps your dog's condition improve even more. Because the length and frequency of laser treatments differ depending on the ailment, consult with your veterinarian to develop a laser treatment program that is appropriate for your dog. After surgery, postoperative laser therapy will help people heal faster, recover faster, and be more comfortable.

Laser treatment for dogs is completely painless and relaxing. Your dog may experience a moderate and relaxing warmth, tingling, or no feeling at all as the laser is applied. Dog laser therapy is highly calming for many dogs. Any worry or tension your dog may be feeling tends to lessen as areas of discomfort or inflammation become more comfortable. (1)

### **4.1.1 Cold Laser Therapy For Dogs**

Laser therapy is also known as Cold Laser Therapy, Low-Level Laser Therapy, or Class IV Laser Therapy. Each of these phrases refers to the same therapy that stimulates cell regeneration and increases blood circulation utilizing the same equipment. (1)

### **4.1.2 Types Of Conditions Can Dog Laser Therapy Be Used To Treat**

Dog laser therapy can be used to treat a multitude of ailments, including:

- Muscle, ligament and tendon injuries
- Post-surgical and soft tissue trauma
- Back pain
- Ear infections
- Gingivitis
- Hot Spots and open wounds
- Arthritis / hip dysplasia
- Degenerative disc disease
- Anal gland infections

Many of our veterinary therapy patients are older animals with musculoskeletal ailments. Some signs that your senior companion is experiencing pain or discomfort are:

- Abnormal sitting or lying posture
- Circling multiple times before lying down
- Restlessness
- Whining, groaning or other vocalizations
- Limping, unable to get up or lie down
- Difficulty getting into car or down stairs
- Lack of grooming
- Won't wag tail
- Licking or biting area
- Lack of appetite
- Trembling

(1)

## **4.2 Laser Therapy For Pain Relief**

Laser treatments are a fantastic technique to relieve pain in your canine companion. Laser therapy relieves pain by lowering inflammation and activating the lymphatic drainage system, which helps to discharge swollen areas. As a result, swelling is reduced, and discomfort is reduced. The lasers also excite nerve cells, which prevent pain signals from reaching the brain and thereby reduce nerve sensitivity. The dog will feel less pain since there is less inflammation, edema, and a disruption of pain impulses to the brain. Laser treatments for dogs also encourage the development of high quantities of naturally occurring endorphins, which help your dog feel better.

(1)

### **4.2.1 Laser Therapy To Recover From Injury Or Surgery**

Laser treatment for dogs is a very useful technique for postoperative healing. In some circumstances, laser therapy may be sufficient to relieve discomfort and speed up the healing process. Laser treatments can help speed up healing, build muscle and tissue, improve mobility, and improve your dog's general quality of life practically instantly because they act directly on injured or afflicted regions. (1)

## **4.3 Side Effects Of Laser Therapy For Dogs**

There are no known negative effects from laser treatment for dogs, and it is deemed both safe and effective by the veterinary community. (1)



**Figure 1 An example of a Class 3 laser. Courtesy Ruby Lynn Carter, LVT, CCRT, Mississippi State University**

## **CONCLUSION**

In general, laser treatment is a new approach that looks to have some subjective benefits, and it is becoming a more widely studied modality that could be a useful tool for veterinary practitioners to successfully treat problems. Wound healing,

pain management, and rehabilitation for a variety of illnesses are all possible applications for laser treatment (eg, Osteoarthritis). For the decrease of pain and inflammation, as well as tissue healing, mechanisms of action have been explored and found. Understanding the fundamentals of light penetration into tissue allows for the optimum dosage to be delivered for the appropriate disease, as well as for a specific patient based on physical characteristics. Photobiomodulation has a number of possible applications, and continuous use of this technology may lead to the discovery of new ones.

## **RECOMMENDATIONS**

Hold the laser at a 90-degree angle to the skin's surface to reduce laser reflection.

Use wavelengths in the range of 600 to 1200 nm, which penetrate deeper into tissue and reduce scatter, and apply the laser directly to the skin to assist neutralize the scatter effect.

Use lasers with larger spot areas for more uniform photon passage, less scatter, and a bigger treatment area.

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