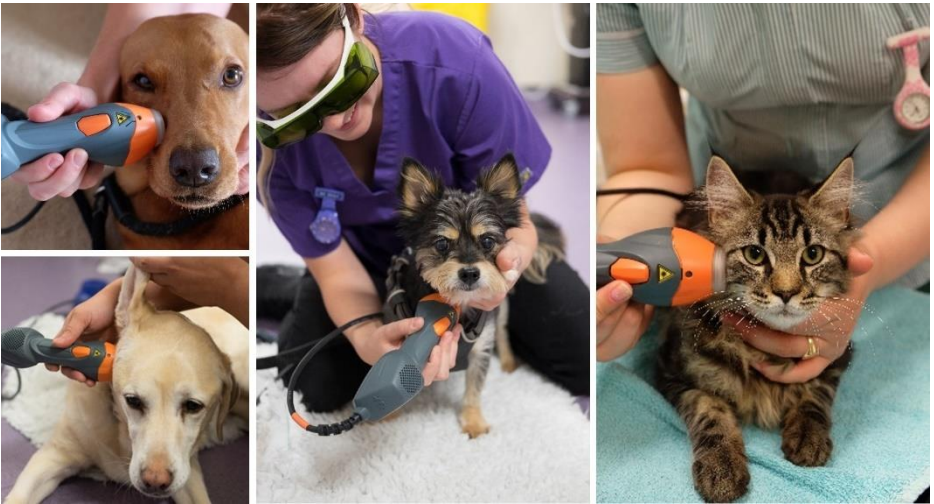


MLS[®] LASER PROTOCOLS



Jenny Hunt BVSc MRCVS

not just

Your partner in pain management

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General dosing regime

Post-op pain management

Applied with the aim of reducing oedema, acute inflammation, pain and self-mutilation. Should be part of multimodal pain management plan. Treatments are applied during anaesthetic recovery period, once any bleeding has stopped, with a second treatment at the post op check.

Acute conditions

Typically treated daily or every other day, and then at decreasing intervals until resolution of the condition. The more acute the injury/inflammation the more important it is to treat daily. An example of a protocol would be - treating daily for 3 days, then every other day until resolution. In the majority of cases, treating more than once a day does not provide substantially improved outcomes.

Chronic conditions

More complicated to treat. Generally take longer to respond than acute conditions. Managed in 3 phases:

Induction phase – up to 12 treatments, administered 2-3 times per week

Transition phase – 1-2 treatments a week for 2-4 weeks

Maintenance phase – one treatment every 2-4 weeks

Patients will often show significant improvement after 3 treatments and good improvement after 6 treatments, but induction should continue until improvement plateaus for two to three treatments.

Some advanced conditions will require the whole induction phase to show any improvement. Review the diagnosis if no response is seen.

Acute on chronic

E.g. IVDD surgery, cruciate surgery.

In cases like these, address the acute condition first by following a daily/EOD treatment regime (for typically 6-10 treatments) until acute component managed, then transition to a chronic programme.

****NOTE – if there is any swelling present, the oedema setting should be used in priority to the other settings, until the swelling has resolved****

Dermatological Conditions

Otitis externa

Used as part of multimodal management to reduce pain and inflammation. Use alongside topical medication based on cytology. Can be used in initial stages to reduce pain and inflammation prior to starting topical medication when otoscopic examination not possible – after laser treatment otoscopic examination and flushing will often be tolerated.

Both the affected pinna and visible ear canal, AND the entire horizontal canal and most of the vertical canal need to be treated.

Application

Pinna

Input manual settings: 36Hz, intensity 100%, 2 minutes, scan mode 50cm² per ear. Scan directly over affected pinna and visible parts of ear canal. Hold 0.5-1cm from contaminated or ulcerated skin.

Ear canal

Input manual settings: 36Hz, intensity 50%, 45 seconds, point mode 3 points per ear. Treat transcutaneously along the palpable ear canal using firm contact if tolerated.

Frequency

Acute

Response to initial treatment is often sufficient that further laser treatment is not required. If pain and inflammation persist, continue laser therapy treatments daily until resolved.

Chronic

Hyperplastic changes in cartilage and canal epithelium dictate more prolonged management and poorer prognosis. Long term aim becomes one of pain management and improved quality of life rather than resolution.

Two or three times weekly for 6-10 sessions, or until a reduction in pain is noted. Then reduce treatment frequency. Long term maintenance-phase treatments are recommended every 3-4 weeks.

Where surgery is required laser therapy can be used to reduce swelling and discomfort and speed of post-operative healing.



Wounds

Laser therapy stimulates better alignment and organisation of collagen fibres hence increasing strength and elasticity of healing tissue. Also, enhancing blood flow and oxygenation to a wound will speed healing and reduce infection. Laser therapy also enhances myofibroblast function and modulates the immune response.

Always include a margin of healthy tissue surrounding the wound in the treatment area. 1-3cm depending on the size of the wound.

If there is a large tissue deficit, use point mode around periphery of wound (including a margin of healthy tissue), then scan mode scanning concentrically towards the middle of the wound.

If oedema is present, treat the area with oedema setting prior to treating as below.

If the wound is infected, use wound infected setting for up to three treatments before continuing with wound setting.

Cover the handset with cellophane or hover 0.5-1cm away from the skin to prevent contamination.

Clean wounds

Application

Wounds setting, point mode.

Frequency

Treat daily for 2-3 days if possible , then every other day until resolution.

Lick Granuloma

Will often require prolonged and aggressive treatment. Attempt to diagnose a primary aetiology where possible (behavioural, musculoskeletal, atopy, peripheral neuropathy) and combine laser therapy with the appropriate adjunctive therapies. Often high dosages are required to resolve these lesions. If the wound is not progressing, increase the dose by increasing treatment time of both settings (to provide a total dose of up to 30J/cm² dosage).

Application

Hot spot AND alopecia x setting, (Phase 1 for first 2 weeks then Phase 2), point mode

Ensure treatment includes a margin of healthy tissue

Frequency

Induction phase – two to three times per week. If no response is noted between the first 2-4 treatments then increase the dosage by 25-50% per treatment (by increasing time) until a positive response is seen.

Transition phase – reduce treatment frequency once clinical response has been noted.

Maintenance phase - A complete resolution is not always possible. Lesions that persist should continue to be treated indefinitely every 3-4 weeks.

Traumatic wounds and venomous bites

Many traumatic wounds will appear worse several days after the incident, especially if they are due to crushing, pressure or thermal insults. This should be anticipated during initial evaluation and laser

therapy should include a wide margin of potential injury as well as the vasculature supplying or draining the injured area.

Application

If oedema is present, treat initially using oedema setting, until swelling has resolved. Point mode around periphery, then scan concentrically over the centre.

Wound setting, point mode around the periphery of the wound.

Frequency

Treat daily for 2-5 days if possible, then every other day. Reduce to twice weekly once strong positive response is seen.

Degloving

Laser therapy will improve the granulation bed, help reduce infection, and improve the rate and quality of epithelialization. If tissue grafts or flaps are used, laser therapy will enhance the survival and proliferation of the grafted tissue. Treat the entire area, as well as a generous margin of healthy tissue. Stimulation of the contributing vasculature will be beneficial to tissue proliferation and graft survival. This can be accomplished by applying laser energy to the proximal or central blood supply. Start at the axilla or groin, or at least one joint above the area of injury. Be aware these injuries can take weeks to heal.

Application

Wound setting, point mode - around the periphery of the wound including margin of healthy tissue, then scan mode over the centre.

If any proud granulation tissue is present – use oedema setting over area itself and proximally to stimulate lymphatic drainage.

Frequency

Treat daily for 2-5 days if possible, then every other day. Reduce to twice weekly once strong positive response is seen. In very large or severe wounds, you can decrease treatment intervals to twice weekly once the wound is showing strong positive clinical response, usually after 10-20 days.

Post-operative incision treatment

Speeds wound healing and reduces suture reaction. Laser can be used if staples are present but will reflect some of the laser beam so angle around staples.

Application

Post-surgery point mode along incision (number of points depends on length of incision)

Frequency

Once immediately post op, once any bleeding has stopped, and once at post-op check

Hot spots/pyotraumatic dermatitis

Laser can be a valuable adjunctive therapy to traditional topical or systemic therapeutics, reducing pain and improving healing. Hover 0.5-1cm from skin to prevent contamination.

Application

Hot spot setting, point mode (number will depend on size of the area) OR scan mode (enter size of the affected area)

Frequency

Can be treated daily or as frequently as feasible until resolved.

Autoimmune and allergic conditions

Systemic therapy is always warranted to help regulate the immune system. Laser therapy can be included alongside topical treatments to mitigate the local dermatological effects.

Application

Atopic dermatitis setting. Scan mode if large area, point mode otherwise

Frequency

Daily for 2-3 days, then every other day. Reducing treatment frequency until resolution.

Prophylactic treatment can be performed every 2-4 weeks or as frequently as required.

Bacterial folliculitis

Laser therapy will reduce inflammation and pruritis, reducing self trauma, and speed wound healing. Additionally, near-infrared laser therapy has been shown to produce photoinactivation of S.aureus, E.Coli, Candida albicans at physiologic temperatures.

Bornstein et al (2015) Near-infrared photoinactivation of bacteria and fungi at physiological temperatures. *Photochem photobiol* **85**(6):1364-1374).

Laser therapy can be included alongside treatment with an appropriate systemic antibiotic, topical medication and treatment of the primary aetiology.

Application

Bacterial skin infection, point or scan mode. Cover with cellophane of hover 0.5-1cm from skin surface to prevent contamination.

Frequency

Daily or every other day for 3-5 treatments. Followed by twice weekly treatments until resolution

Alopecia (non-inflammatory)

E.g. seasonal flank alopecia, alopecia X, colour-mutant alopecia

Where viable hair follicles exist, laser therapy is warranted to aid hair re-growth.

Phase 1

Application

Alopecia X phase 1, scan mode

Frequency

Twice weekly for two weeks

Phase 2

Application

Alopecia X phase 2, scan mode

Frequency

Twice a week for 4 weeks. Then once weekly for 4 weeks. Continue as required.

Elbow Hygroma

Treatment is often frustrating, and laser therapy can be used in addition to other forms of therapy (aspiration, surgical drainage, excision, protective bandaging). Will often require prolonged and aggressive treatment.

Application

Oedema in point or scan mode

Frequency

Induction phase – every other day or three times a week.

Transition phase – reduce treatment frequency once clinical response has been noted.

Maintenance phase - A complete resolution is not always possible. Lesions that persist should continue to be treated indefinitely every 3-4 weeks.

Feline acne

Application

Bacterial skin infection, point mode

Frequency

Short series of sessions daily or every other day until resolution. If recurrence than treatment can continue as frequently as required to control symptoms.

Acute anal sacculitis

Laser can significantly reduce pain and inflammation in acute anal sacculitis, and can be an excellent alternative to corticosteroids in

preventing continued symptoms. Can be used alongside conventional therapy.

Application

Perianal fistula, point mode over each anal gland, and any areas of self-trauma.

Frequency

Most cases resolve quickly after expression of the anal glands and laser therapy, and require no further treatment, unless symptoms recur when glands refill.

Chronic anal sacculitis

Laser therapy can be beneficial in addition to systemic antibiotics (based on culture and sensitivity), anti-inflammatories, and repeated manual expression/flushing of the sacs.

Application

If infected - Perianal fistula (infected) point mode over each gland.

No infection – Atopic dermatitis point mode over each gland

Frequency

Induction phase – two to three times a week.

Transition phase – reduce treatment frequency once clinical response has been noted.

Maintenance phase - A complete resolution is not always possible. Lesions that persist should continue to be treated indefinitely every 3-4 weeks.

Anal furunculosis

Laser therapy can be used as an adjunct to medical protocols. The reduction of pain and inflammation can have a significant effect on quality of life.

Ghibaudo G, Marchingiglio G. (2017) Use of low-level laser therapy (LLLT) for perianal fistulas drug-unresponsiveness in German shepherd dogs. *Clinica Veterinaria*

Application

Perianal fistula (infected) setting for three sessions then Perianal fistula setting, point mode. Treat glands, affected area and a margin of healthy tissue.

Frequency

Induction phase – every other day for three weeks. If no response is noted between the first 2-4 treatments then increase the dosage by 25-50% per treatment (by increasing time) until a positive response is seen.

Transition phase – reduce treatment frequency to twice weekly for two months.

Maintenance phase – Prognosis is guarded. Lesions that persist should continue to be treated indefinitely every 3-4 weeks.



Early stages of anal gland furunculosis in a German Shepherd dog.

Day 1 and Day 6.

Treatment with high dose steroid and laser therapy every other day.

Pododermatitis

Regardless of aetiology pododermatitis is often painful and chronic. Management includes identifying and treating the primary aetiology. Avoid laser therapy if neoplasia present.

Application

If oedema present then use oedema setting, point or scan mode.

Then chronic inflammation, point or scan mode treating the foot from palmer/plantar and dorsal directions.

Frequency

Acute conditions

Acute superficial inflammation may only need single treatments. Treatment can be continued daily or every other day as required.

Chronic conditions

Induction phase – every other day or three times a week.

Transition phase – reduce treatment frequency once clinical response has been noted.

Maintenance phase – Prognosis is guarded and a complete resolution is not always possible or recurrence is common. Lesions that persist should continue to be treated indefinitely every 3-4 weeks.



Ulcerative pododermatitis
Not responsive to systemic
antibiotics or steroids
Laser therapy three times a
week for 2 weeks

Aural Haematoma

Laser therapy improves circulation, enhances haematoma absorption, and accelerates degradation of fibrin clots, and can be included in any aural haematoma management protocol.

Application

Oedema, point setting

Frequency

Immediately post-operative or after draining the haematoma. Then every third day until resolution.

If injecting corticosteroid, treat once with laser therapy PRIOR to administering the injection. Laser can cause crystallisation of injected substance so shouldn't be used over the injection site until the drug has been metabolised.

Intraoperative Laser Therapy

There are multiple advantages of the intraoperative use of therapeutic laser:

- Laser can be delivered much earlier – when applied almost immediately after tissue trauma, laser therapy results in a decrease in the release of cytokines and reduction in inflammatory cell activity.
- Therapy can be pinpointed to localised areas.
- Photon absorption in superficial tissues is avoided so the affected tissue can be more accurately dosed.
- Immediate increase in perfusion to the affected tissues is achieved.

Care must be taken not to interfere with aseptic environment – laser can be delivered without touching the tissues (hover 1-2cm away) and the handpiece and cable thoroughly cleaned prior to use (non-alcoholic disinfectant). The 'intra-oral' probe can be sterilised in an autoclave – see instruction manual for more details.

Enterotomy/Enterectomy

In absence of neoplasia, laser therapy is indicated immediately after closure of the small intestines. Visible improvement in tissue colour and motility can often be seen within a few minutes of laser therapy as tissue perfusion improves.

Application

Regular handset: Acute inflammation, point setting – useful for surgeon to present and move the intestines during treatment to maximise penetration from as many different directions as possible.

'Intra-oral' probe: Acute gingivitis-stomatitis, point setting. Increase time or intensity to give $1\text{J}/\text{cm}^2$

Cystotomy

Laser therapy can be very beneficial in cystotomy patients. Treat immediately after cystotomy incision is closed.

Application

Regular handset: Acute inflammation, point setting.

‘Intra-oral’ probe: Acute gingivitis-stomatitis, point setting. Increase time or intensity to give $1\text{J}/\text{cm}^2$

Since most cystotomy patients have some degree of cystitis, the bladder is treated with laser therapy through the body wall daily for 3-5 days following surgery. Use chronic pain AND chronic inflammation setting, scan mode (see cystitis).

Urethral obstruction

The success rate of displacing the urethral blockage or calculi with retrograde flushing will be higher if laser therapy is administered before passing a catheter.

Application

Use contracture in point setting over suspected location of obstruction and surrounding area

Musculoskeletal Disorders

Cruciate Disease

Case selection based upon degree of damage to the ligament and weight of the animal – surgery will still be required in the majority of cases. Laser therapy can be used as part of conservative management and post-surgery to reduce pain and inflammation and improve healing. If metal implants are present then direct laser around the implant rather than directly over it or reduce the intensity to 50%. The laser beam will primarily be reflected by metal implants so the implants themselves don't heat up but the soft tissue overlying will effectively be receiving an increased dose.

Conservative management

If acute and oedema is present, then use Oedema setting in scan mode and treat daily until the swelling has subsided, then move onto chronic protocol. If chronic then treat as per osteoarthritis.

During/Post surgery

During: Immediately after closing the joint capsule, using the 'intra-oral' probe (this probe can be sterilised in an autoclave – see instruction manual).

Post-surgery: Immediately post op to reduce post-operative swelling, oedema, pain and acute inflammation.

Application

Intra-oral probe: Acute gingivitis-stomatitis setting – increase time or intensity to give $1\text{J}/\text{cm}^2$, point mode.

Regular handset:

- a) Oedema setting, scan mode - with gentle massage treat the entire stifle area, extending distal and medial to the stifle to include all soft tissue affected by post-op swelling
- b) Acute pain setting, scan mode – treat stifle area, concentrating on osteotomy site

Frequency

Immediately post-op, then 24 hours later. Once the oedema has resolved, use Acute Pain or Fracture setting (depending on surgical technique) only.

Continue every other day for 10 days.

If necessary after 10 days then continue twice-weekly treatments until a good functional result is achieved. Long term treatment can be given if chronic changes in the joint are suspected (as per osteoarthritis)

Fractures/Osteosynthesis

As well as its important effects on soft tissue, laser therapy plays an important role in activating osteogenic factors, stimulating osteoblastic cells and accelerating bone healing. Can be used to treat surgically fixated fractures or delayed/non-union.

Start laser therapy immediately after wound closure.

Application

Fracture AND Acute pain setting applied to the fracture site, circumferentially around the fractured bone, moving from proximal to distal.

Reduce intensity to 50% when using directly over metal implants

Frequency

Repeat daily for 3-5 days, then every other day until 10-14 days after surgery

Depending on functional result, degree of swelling, and wound healing discontinue at this stage. Or continue twice weekly for as long as necessary until functional result or union is achieved.

Osteoarthritis

Each patient should be completely evaluated for affected joints and areas of pain. The clinical response will vary greatly if laser therapy is not performed on the correct target joints. Chronic pain requires aggressive therapy initially to establish a good cellular response and initiate the anti-inflammatory effect so an induction course is essential.

Application

Chronic Arthritis setting, point mode

Ensure entire joint is treated including ligament and tendon insertions. Use passive range of motion exercises during treatment where tolerated, to enable laser delivery to as much of the articular surface as possible.

Frequency

Induction - Two to three times weekly for two to three weeks (at least six sessions in the first 3 weeks)

Transition - Once weekly for 2-4 weeks

Maintenance - slowly increase treatment interval. Majority of cases require therapy every 3-6 weeks

****Ensure any affected surrounding soft tissue and compensatory biomechanical changes are treated including trigger points (point mode) and contracture setting (scan mode)**

Hindlimb – check paralumbar muscles, quadriceps and adductors

Forelimb – check triceps, shoulder and neck muscles

Tendon/Ligament/Muscular injuries

Ideally laser therapy should be used in combination with a comprehensive rehabilitation programme (including physiotherapy and hydrotherapy where appropriate), with the aim to reduce adhesion formation and achieve return to full function.

Application

Sprain/strain setting, point OR scan mode.

If oedema/swelling is present use oedema setting until the swelling has resolved, then switch to sprain/strain setting.

Frequency

Two to three times weekly until clinical response is noted. Chronic injuries will need much longer courses of treatment – see chronic conditions under general dosing regimen.

Trigger point

Hyperirritable spots in the fascia surrounding skeletal muscle often due to chronic musculoskeletal disorders. Often able to palpate nodule within the muscle fibres which elicits a pain response (local tenderness, referred pain, or local twitch response).

Laser can often cause an immediate reduction in pain due to its effect on endplates and c-fibres.

Advise to check for trigger points when treating arthritic joints or chronic muscular disorders.

Application

Trigger point setting

Treat each trigger point up to three times within the same session (re-palpate between each application)

Frequency

In line with treatment for arthritis/back pain etc. 2 treatments weekly for 3 weeks as induction course then review. Taper treatments as condition improves.

Muscle contracture

Contracture setting, scan mode – apply gentle pressure in a massaging movement over whole muscle

Respiratory conditions

Laser therapy is an effective modality in reducing pain, modulating the inflammatory response and increasing the microcirculation in both upper and lower respiratory conditions. Anecdotal results reported in the veterinary profession have been consistent with these findings.

Multiple studies have verified that transcranial therapy is possible, with an inverse relationship between the thickness of bone and the percentage of photonic transmission through it. Hence in large breed dogs, if treating through bone, increase time of treatment by 100%.

Patients to wear wavelength specific goggles or cover the eyes with a dark coloured towel or hands if treating around the head.

Upper respiratory conditions

Rhinitis and Sinusitis

Ensure malignancy is ruled out. Incorporating laser therapy into treatment plan when microorganisms are present is warranted as laser increases the metabolic rate and fungicidal activity of neutrophils. Laser-assisted nasal decolonization of *Staphylococcus aureus*, including MRSA, was demonstrated in human patients.

Kreps Y,P, and Kizhner V (2012)Laser-assisted nasal decolonisation of *Staphylococcus aureus*, including methicillin-resistant *Staphylococcus aureus*. Am J Otolaryngol. 33(5):572-575

Acute

Application

Chronic inflammation point mode treating both nasal passages, frontal and maxillary sinuses.

Frequency

Daily or every other day with gradual transition to less frequent treatment when condition resolves

Chronic

Application

Chronic inflammation setting, point mode treating both nasal passages, frontal and maxillary sinuses. Increasing intensity to 100% is recommended in larger dogs with thicker bones.

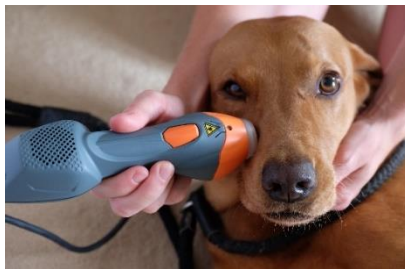
Frequency

Induction phase – every other day

Transition phase – once symptoms start to resolve reduce to twice weekly, gradually reduce further to weekly, then every other week etc.

Maintenance phase – continue at a frequency that maintains the clinical response.

***if symptoms are severe 2-3 treatments per day can be administered



Tonsillitis

Laser therapy can be a good adjunct therapy. Treated with the mouth open, under sedation, so that the light directly treats the tonsil. Otherwise to treat consciously, aim the beam at the pharynx from the caudal border of the mandible with the handpiece in contact with the skin.

Application

Chronic inflammation, point setting

Frequency

Daily or twice daily (depending on severity of symptoms), and then reduce to every other day until resolution.

Laryngitis

Treatment should address the underlying aetiology, but symptomatic treatment to decrease laryngeal oedema and swelling of the mucous membranes is often indicated. Laser therapy is indicated for any form of laryngitis except where malignancy is the underlying aetiology.

Application

Chronic inflammation, point setting in direct contact with the skin.

Frequency

Daily or twice daily (depending on severity of symptoms), and then reduce to every other day until resolution.

Laryngeal paralysis

Laser therapy is indicated in pre- and postoperative patients undergoing surgery and in patients with milder symptoms that are not deemed immediate surgical candidates, to reduce pain and oedema secondary to chronic inflammation.

Application

Chronic inflammation, point setting in direct contact with the skin.

Frequency

Daily or twice daily (depending on severity of symptoms), and then reduce to every other day until resolution.



Lower Respiratory Conditions

Laser therapy should be administered with the handpiece in contact with the skin. When treating diffuse disease of the lower respiratory tract, the entire surface area of the thorax should be treated. Penetration into the thorax can be facilitated by following the intercostal spaces as far as possible.

Ensure to rule out malignancies prior to commencing laser treatment.

When treating the neck, care should be avoided to prevent prolonged exposure to the thyroid gland, though occasional inadvertent exposure is not contraindicated.

A 10cm x 10cm template card (= 100cm²) can be used to estimate size of area to be treated.

Chronic Obstructive Pulmonary Disease/Chronic bronchitis

Aim to decrease symptoms to a tolerable degree, as well as dose and frequency of oral medications.

Application

Chronic inflammation setting, scan mode, treat over entire thorax

Frequency

Induction phase – daily or every other day

Transition phase – very gradual decrease in frequency as dictated by the improvement of symptoms

Maintenance phase – frequency dictated by patients response – treat every 1-4 weeks

****if no response is noted then increase treatment time gradually by up to 100%****

Feline Asthma

Due to the inflammatory nature of feline asthma, laser therapy should be considered as an adjunctive therapy. A study in mice has shown that laser therapy inhibits bronchoconstriction, Th2 inflammation, and airway remodelling in experimentally induced asthma.

Silva. V.R *et al* (2014) Low-level laser therapy inhibits bronchoconstriction, Th2 inflammation and airway remodelling in allergic asthma. *Respir Physiol Neurobiol* **194**:37-48

Aim to decrease symptoms to a tolerable degree, as well as dose and frequency of oral medications.

Application

Chronic inflammation scan mode, treat over entire thorax

Frequency

Induction phase – daily or every other day

Transition phase – very gradual decrease in frequency as dictated by the improvement of symptoms

Maintenance phase – frequency dictated by patients response

****if no response is noted then increase treatment time by up to 50%****

Tracheobronchitis

Laser therapy can play an adjunctive role in reducing the inflammatory component of tracheobronchitis, although an appropriate diagnostic work up should always be performed to enable formulation of the appropriate treatment plan.

Aim to decrease symptoms to a tolerable degree, as well as dose and frequency of oral medications.

Application

Chronic inflammation scan mode, treat trachea and entire thorax

Frequency

Induction phase – daily or every other day

Transition phase – very gradual decrease in frequency as dictated by the improvement of symptoms

Maintenance phase – frequency dictated by patients response, treat every 1-4 weeks

****if no response is noted then increase treatment time by up to 50%****



Oral Conditions

Post-operative dental extraction

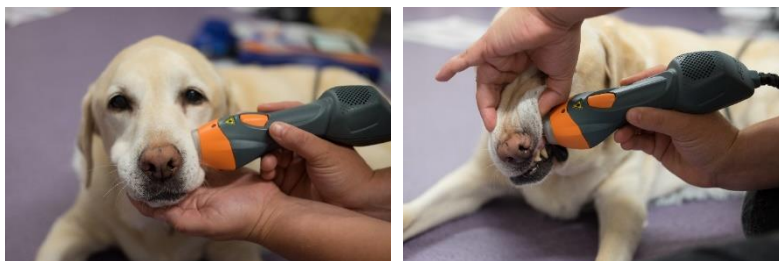
Oral pain following dental extractions can be profound, due to the high concentration of c-fibres found in pulp tissue. Use immediately after haemostasis (human studies have demonstrated that immediate laser therapy post-extraction has significant benefit when compared with delayed therapy).

Application

Acute pain, point setting

Frequency

Immediately post op. Repeat at post op check



Periodontal disease

Adding laser therapy to the overall management plan for periodontal disease will help reduce the patient's oral pain and inflammation.

If the animal is under sedation or general anaesthesia, the 'intra-oral' probe can be used at a distance of 1cm from the tissues, otherwise, with the animal conscious, the standard handpiece can be held in contact with the cheek.

Severity, chronicity and the patients degree of discomfort should dictate how often the patient is treated.

Application

Regular handset: Chronic inflammation, point or scan mode

Intra-oral probe: Chronic gingivitis-stomatitis setting, point or scan mode, increase time or intensity to give dose of 1J/cm²

Frequency

Treat once during procedure or immediately post-op and once at post-op check.

Feline gingivitis-stomatitis

Management requires a multimodal approach often including full or partial mouth extraction, and medical therapy to control inflammation, infection and pain. Laser therapy can be included to reduce oral pain and inflammation. Although lesions may not improve in appearance following laser therapy, anecdotal reports suggest significantly reduced clinical signs.

It is possible to treat consciously with the mouth closed. The number of points depending on the age of the animal. In young cats – treat with one point over left and right arcade, one point over the incisors, and one point upwards via the intermandibular space. In larger/older cats – treat with two points over each arcade, one point over the incisors and one point upwards via the intermandibular space. The submandibular and prescapular lymph nodes can be treated also.

If the animal is under general anaesthesia, the 'intra-oral' probe can be used in point mode or scan mode, hovering 1cm from the tissues.

Severity, chronicity and the patients degree of discomfort should dictate how often the patient is treated.

Acute

Application

Regular handset: Acute gingivitis-stomatitis, point mode (treat through the cheek/lips)

Intra-oral probe: Acute gingivitis-stomatitis, point mode or scan mode (aim directly over the gingival margin, hover 5mm)

Frequency

Three times per week for 4-6 treatments. Stop when resolved.



Chronic

Application

Regular handset: Chronic gingivitis, point mode (see notes above for number and location of points).

Intra-oral probe: Chronic gingivitis-stomatitis, point mode or scan mode.

Frequency

Three times a week for two weeks, then twice per week. Continued management is often essential for success - patients can often be managed on one treatment per month. Premature reduction in frequency of laser treatment may lead to perceived failure.

Canine stomatitis/chronic ulcerative paradental stomatitis

Management of this condition can be very frustrating. However, given the established ability of laser therapy to reduce pain and inflammation associated with oral mucositis, it should be considered in canine stomatitis as part of a multimodal approach (focus should remain on scrupulous plaque control, and teeth with concurrent periodontal disease should be extracted).

If possible treat with the mouth open directly. When treating the buccal or labial mucosa, lifting the lips without opening the jaw is often tolerated. If the patient does not tolerate treatment with the mouth open then treatment can be delivered over the affected area through the facial tissues.

Severity, chronicity and the patients degree of discomfort should dictate how often the patient is treated.

Application

Chronic inflammation, point mode or scan mode

Frequency

Induction - every other day until a desirable clinical response is seen. If the patient is severely painful, treat daily for 3-4 days before commencing every other day treatment.

Transition - reduce frequency gradually

Maintenance - treatment frequency will aim to keep the patient at the desired level of comfort. Continued management is essential for success. Premature reduction in frequency of laser treatment may lead to perceived failure.

Oral wounds

Treatment of oral wounds can be accomplished with the mouth open or closed, although direct light exposure is preferable.

Mouth open

Application

Intra-oral probe: Tongue ulcer setting, point mode

Mouth closed

Regular handset: Wound setting, point mode. Treat the area twice or increase intensity to 100% if penetrating through thick tissue or bone.

Frequency

Treat daily for 2-3 days if possible, then every other day until resolution.

Mandibular fractures

Treat immediately to decrease inflammation and pain, and then again after fracture repair to enhance healing.

Care over implants as laser is reflected – reduce intensity to 25%

Application

Fracture setting, point mode – angle around the implant to treat bone.

Frequency

Apply at the time of fracture fixation, then two to three times a week for 3-4 weeks or until healing is noted radiographically.

Eosinophilic Granuloma Complex

Treatment is dependent on the severity and underlying cause. Laser is a beneficial addition to the treatment plan. Often higher energy doses are required.

Application

Eosinophilic granuloma, point setting

Frequency

Two to three times a week until resolution

If no response is noted then repeat treatment up to 3 times per session. Often higher energy doses are required.

Lip fold dermatitis

Laser can be used as an adjunctive therapy alongside topical ointments, shampoos, antibiotics. Where surgery is required, laser can be utilised to improve wound healing. Hover 0.5-1cm from skin or cover handset with clingfilm to prevent contamination. Treat with laser prior to application of topical treatments.

Application

Bacterial skin infections setting, point mode.

Frequency

Daily or every other day until resolution. In frequently recurring cases, long term maintenance treatments every 7-14 days may help avoid acute exacerbations.

Salivary mucocoele

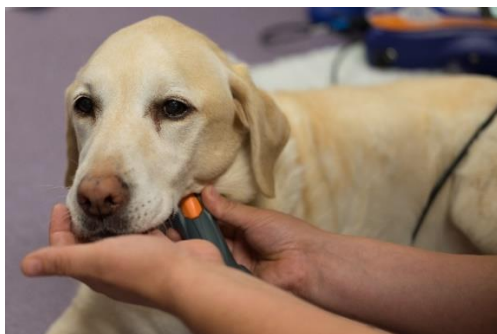
Laser therapy has been shown to decrease pain and swelling of salivary glands, making it useful for treating patients prior to corrective surgery. The affected salivary gland and associated lymph nodes should be treated.

Application

Oedema, point mode over inter-mandibular space and ventral neck.

Frequency

Daily or every other day



Oropharynx

Laser therapy downregulates the expression of inflammatory cytokines related to oral mucositis. It has been shown that laser therapy can be used prophylactically to prevent the development of oral mucositis in human cancer patients being treated with chemotherapy or oral radiation, as well as the treatment of this condition.

Stomatitis in cats and dogs that does not relate to the hypersensitivity reaction to periodontal bacteria can be greatly helped with laser therapy. If there is a hypersensitivity reaction, laser therapy can still be used to reduce the inflammation and control pain.

See oral disease for treatment protocol

Abdominal conditions

As inflammation is a common symptom of most gastrointestinal and urinary diseases, laser therapy can be a useful modality to include in treatment plans, particularly in cats and small dogs. The stomach, pancreas, and urinary tract can be more difficult to reach transcutaneously in large dogs. Treating the organ itself and the regional lymph nodes will aid in decreasing inflammation and stimulate tissue regeneration.

Accurate diagnosis is imperative to rule out malignancy.

Cystitis/Recurrent Urinary Tract Disease

Used as part of multimodal management to reduce pain and inflammation. Obtain an accurate diagnosis as far as possible to ensure no malignancy.

It is worth treating the bladder itself as well as the dorsal root ganglia (L2-4 for the hypogastric nerve and S1-3 for the pudendal and pelvic nerves). Wind-up of neuropathic pain is thought to play a role in the persistent and recurring nature of FLUTD. Laser therapy of the innervation of the dorsal root ganglia supplying the bladder can help to down regulate the acute and chronic pain.

Application

Chronic inflammation setting in scan mode (size of area to be treated will depend on bladder size). Treat from right lateral, left lateral and ventral abdomen as well as over the spine as described above.

Frequency

Treat two to three times per week until symptoms resolve. If recurrence then treat as frequently as required to control symptoms E.g. start on induction course of two to three sessions per week until

symptoms resolve, then reduce to once weekly treatments for one month, then treat every 2-4 weeks depending on requirement.



Urethral disease

Distal blockages with grit can often be unobstructed by the application of laser and gentle milking of the obstruction. Once the patient is sedated the penis can be extruded and treated directly. This causes a decrease in the peri urethral inflammation, making it possible to reduce spasm and un-obstruct the animal in some cases. A catheter will need to be placed if a good urine stream does not result. If crystals are present, pre-treatment with laser may make passing a catheter easier.

Application

Acute inflammation setting, point mode

Frequency

If urethral spasm causes ongoing clinical signs, then treatment can continue daily until resolution

Pancreas

Pancreatitis is painful and involves severe inflammation and reduced microcirculation to the pancreas. Since laser therapy promotes analgesia, increases microcirculation, decreases inflammation and reduces oxidative stress, it is an important adjunct to conventional treatment of pancreatitis. Ensure malignancy is not present.

Application

Chronic pain, scan mode over right and mid-cranial abdomen. Also treat sublumbar and inguinal lymph nodes.

Frequency

Every 12-24 hours, until resolution

Liver

Laser therapy has been shown to reduce hepatic oxidative stress caused by nitric oxide free-radical metabolites and pro-inflammatory cytokines, leading to a reduction in hepatic inflammatory infiltrates. Laser has also been shown to recruit mesenchymal stem cells, induce angiogenesis, improve microcirculation, and stimulate hepatocyte regeneration in injured livers.

Burduli N.M *et al* (2015) The influence of low-frequency laser radiation on microcirculatory disorders in patients presenting with chronic viral hepatitis. *Vopr Kurotol Fizioter Lech Fiz Kult.* **92** (4):25-29

Laser therapy can be used in companion animals alongside traditional medical treatment to enhance resolution of acute hepatic insults as well as to improve the clinical outcome for chronic liver conditions.

Application:

Chronic inflammation scan mode – treat entire liver transcutaneously

Frequency:

Acute

Treat every 24-48 hours until resolution

Chronic

Treat every 24-48h hours until patient stabilises, then titrate treatments down to once every other week. Treatment may need to continue indefinitely.



Neurological conditions

Intervertebral disc disease

Even in the absence of persistent compression, decreased perfusion, local oedema and secondary oxidative damage play a key role in the extent and severity of spinal cord injuries. Hence given laser therapies positive effects on tissue perfusion and oedema, it is an excellent modality to include in IVDD cases. Also effective in influencing nerve regeneration. Can be useful both additionally to medical management or post-surgery.

Draper W.E *et al* (2012) Low level PBMT reduces time to ambulation in dogs after hemilaminectomy: a preliminary study. *J Small Anim Pract.* **53**(8):465-469

Conservative management

Application

IVDD setting, point mode. Directly over the paravertebral muscles (bilaterally) and directly at spine between dorsal spinous processes (treat two disc spaces cranial and three caudal to injury). When treating cervical lesions, direct the laser from the dorsolateral side toward the intervertebral foramen on both sides (as there is considerably more muscle mass between the skin and spinal cord in the neck).

If there is a lot of tension in the paravertebral muscles you can also use the contracture setting in scan mode over the affected area

Frequency

Treat daily until clinical progress is noted, then every 2-3 days until the patient is ambulatory and passing urine and faeces satisfactorily, then weekly until fully recovered.

Post surgery

Application

Oedema setting, point or scan mode over the incision site

Frequency

Twice to three times weekly for two to three weeks. Taper treatment frequency as condition improves.

Peripheral Nerve injuries

Laser therapy can increase the rate of peripheral nerve regeneration and motor neuron survival. Ideally treat the injury immediately as this will reduce the noxious cellular and biochemical environment and limit the extent of the damage.

Application

Chronic inflammation, point mode or scan mode.

Frequency

Daily for 3 days, then every 2-3 days until resolution.

Note: recovery of peripheral nerve injuries is a long, slow process, in which axonal growth rates may reach 1-5mm/day. Thus laser therapy should continue for at least 8 weeks or until acceptable function has returned.

Cognitive Dysfunction Syndrome

The brain is rich in mitochondria and close to the skin surface which makes it an ideal recipient of the benefits of laser therapy. Studies have demonstrated that transcranial penetration is possible, though penetration is reduced through thicker bone.

Laser therapy has been shown to have potential as an effective, minimally invasive intervention for mitigating, and even reversing, progressive cerebral degenerations in transgenic mice.

Purushothuman, S *et al*(2014) Photobiomodulation with near infrared light mitigates Alzheimer's disease-related pathology in cerebral cortex – evidence from two transgenic mouse models. *Alzheimers Res Ther* 6(1):2

Application

Chronic inflammation in scan mode on dorsal surface of the skull, treating both right and left lateral hemispheres. In a large dog increase treatment time by 25-50%.

Frequency

Twice weekly for 2 weeks, then once a week for 2 weeks, then every 2-3 weeks as needed for maintenance.



Exotics

Small Mammals

Abscesses

Abscess tend to heal more rapidly when treated with laser therapy

Application: Abscess setting, point mode (include a healthy 2cm margin of tissue)

Frequency: daily or every other day until strong clinical response then reduce to twice weekly/weekly until resolution.

Hair loss

Regardless of the underlying cause, many of these patients will show hair coat improvement with the use of laser therapy if the hair follicles are viable. The underlying aetiology should be ascertained to ensure appropriate medical intervention and best outcome.

Application: alopecia setting, point or scan mode

Frequency: twice weekly until response is seen, reducing treatment frequency down until resolution

Wounds

All wounds, whether lacerations, surgical, superficial or deep heal much more rapidly and with fewer complications

Surgical: wound (surgical) setting, point mode. Treat immediately after surgery then at 24-48 hours post-op.

Deep: abscess setting, point mode. Treat daily or every other day until a response is seen, then to twice weekly or weekly until resolution.

Superficial: wound setting point mode. Treat daily or every other day until a response is seen, then to twice weekly or weekly until resolution.

Pododermatitis

Common foot lesion resulting from improper flooring, substrate, and hygiene and obesity. A multimodal approach to these cases is necessary (topical medication, bandaging, improvements in husbandry) but laser therapy will reduce pain and speed would healing.

Application: pododermatitis setting, point mode

Frequency: two to three times weekly until resolution

Osteoarthritis

Application: Arthritis setting, point mode

Frequency: two to three times weekly for 2-3 weeks, reducing frequency of treatments until maintenance is achieved.

Fracture

Patients have healed in 25-50% less time than those without laser therapy. Laser is scattered by bandage material so fractures cannot be treated through casts or splints. To overcome this, practitioners can design the splint or cast with a small window or fenestration over the fracture site.

Application: fracture setting point mode

Frequency: two to three times weekly for 3-4 weeks, then re-asses radiographically. Continue weekly until union is achieved.

Muscular sprain/strain

Application: acute inflammation, point or scan mode

Frequency: Often only a few sessions required, repeated over a couple of weeks

Spondylosis

Common in rabbits due to inherent biomechanics. Analgesia and anti-inflammation can be achieved with laser therapy.



Application: chronic pain setting in point mode over site of spondylosis, chronic pain setting in scan mode over paralumbar muscles.

Frequency: two to three times weekly for 2-3 weeks, reducing frequency of treatments until maintenance is achieved.

Spinal cord injury

Two different rat models of spinal cord injury (hemisection and contusion), demonstrated promotion of axonal regeneration and functional recovery with transcutaneous laser irradiation.

Byrnes K.R, *et al* (2005) Light promotes regeneration and functional recovery and alters the immune response after spinal cord injury. *Lasers Surg Med.* **36**(3):171-185

Application: chronic inflammation setting, point mode

Frequency: two to three times weekly until resolution.

Dental disease

Laser therapy is beneficial in controlling the pain and inflammation associated with the trimming and extraction of affected, as well as in the healing of the oral soft tissues and subsequent jaw and temporomandibular lesions.

Post extraction: dental extraction aftercare setting, point mode. Single treatment immediately post-op. Repeat 48 hours if required.

Abscess: oral abscess setting daily or every other day until appetite returns, then twice weekly to resolution.



Otitis/torticollis

Application: chronic inflammation setting point mode

Frequency: two to three times weekly until resolution

Birds

Feather disorders

The underlying causes are numerous and varied. Regardless of the underlying cause laser therapy can benefit patients that still possess some degree of follicular activity, by reducing inflammation in folliculitis, and stimulating feather re-growth in quiescent follicles.



Application: Feather loss, point setting

Frequency: two to three times per week until clinical response is seen

Wounds

Superficial lacerations

Application: wound setting point mode. If infected, then wound (infected) setting can be used for up to three treatments.

Frequency: daily or every other day until significant clinical response is seen. Then reduce treatment frequencies to twice weekly until resolution.

Pododermatitis

Application: Pododermatitis setting AND wound setting, point mode

Frequency: daily or every other day until significant clinical response is seen. Then reduce treatment frequencies to twice weekly until resolution.

Deep wounds/self-mutilation

Application: wound setting point mode. If infected, then wound (infected) setting can be used for up to three treatments.

Frequency: daily or every other day until significant clinical response is seen. Then reduce treatment frequencies to twice weekly until resolution.

Arthritis

Regardless of predisposing factors, laser therapy can help with pain and inflammation.

Application: Arthritis setting point mode

Frequency: two to three times per week initially until clinical response is seen then maintenance every 10-14 days. Most cases are treated on an as needed basis once initial joint pain is reduced.

Gout

Laser therapy reduces pain and inflammation of affected joints, with some cases having significant decrease in swelling of the joints.

Application: chronic pain setting, point mode

Frequency: two to three times per week initially until clinical response is seen then maintenance every 10-14 days, or as required.

Fractures

Tibia-tarsal fractures in cockatiels heal within 2-3 weeks when using laser twice weekly for 2 weeks along with proper splinting of the fracture site.

Application: fracture setting, point mode

Frequency: two to three times weekly for 2-3 weeks, then re-asses radiographically. Continue weekly until union is achieved.

Muscular sprain/strain

Application: chronic pain, point or scan mode

Frequency: single session will result in significant improvement in an acute injury. Continue daily or every other day until resolution.

Reptiles

Abscesses

Application : abscess setting, point mode

Frequency : two to three times weekly until resolution

Blister disease

Application: wound setting, point mode. Reduce time by 50% to give a dose of $2\text{J}/\text{cm}^2$

Frequency: daily or every other day until strong clinical response then reduce to twice weekly/weekly until resolution.

Carapace lesions

In a case study involving a soft-shelled tortoise with deep severe dermal laceration to the carapace, leg and plastron, laser therapy subjectively improved the healing time of the areas treated as compared to those untreated.



Application: carapace lesion setting, point mode.

Frequency: daily or every other day until strong clinical response then reduce to twice weekly/weekly until resolution.

Lacerations

Laser can contribute to a 25% reduction in recovery time

Application: wound setting, point mode

Frequency: daily or every other day until strong clinical response then reduce to twice weekly/weekly until resolution.

Pododermatitis

Application: wound setting point mode. If infected, then wound (infected) setting can be used for up to three treatments.

Frequency: daily or every other day until strong clinical response then reduce to twice weekly/weekly until resolution.

Thermal burns

Application: wound setting, point mode

Frequency: daily or every other day until strong clinical response then reduce to twice weekly/weekly until resolution.

Deep extensive wounds normally take months to resolve with standard treatment protocols, but when laser therapy is added to the regime, they can resolve within several weeks, with a typical 25-30% reduction in overall healing time.

Arthritis

Application: Arthritis setting, point mode

Frequency: 2-3 times per week for 2-3 weeks, then taper frequency of treatments to maintain comfort.

Fibrous osteodystrophy/metabolic bone disease

Addition of laser therapy can help to strengthen bone integrity and speed recovery in these patients.

Application: fracture setting, point mode

Frequency: 2-3 times per week until significant improvement clinically. Then taper treatment frequency until resolution.

Fractures

Typically fractures heal 25-30% quicker with laser therapy

Application: fracture setting, point mode

Frequency: two to three times weekly for 2-3 weeks, then re-assess radiographically. Continue weekly until union is achieved.

Common reasons for perceived Treatment Failure or Inconsistent Results

1. Treating the incorrect area: ensure that a recent complete orthopaedic, neurological and pain examination has been carried out. Re-asses this regularly.
2. Not treating all the problem areas: ensure all sources of pain are being addressed including compensatory biomechanical changes (e.g. trigger points and muscle contractures).
3. Change in patient activity or medications: make sure to enquire about any changes with the owner as they may taper the medication or increase exercise levels as the pet improves.
4. An exacerbation of the condition: more commonly seen after initial improvement, subsequent worsening may require additional pain management and further diagnostics.
5. Presence of an undiagnosed problem: repeat radiographs and examinations to rule out malignancy if joint or bone pain does not respond.
6. An inappropriate induction phase or the need for a mini re-introduction phase: ensure that an appropriate induction phase has been given before weaning to a maintenance phase. Guidelines are given above, but these can be tailored to the individual.

Ref: Laser Therapy in Veterinary Medicine, Photobiomodulation.
Ronald R, Godbold J. Wiley Blackwell.