In dogs does low level laser therapy reduce healing time?

A Knowledge Summary by

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PICO question

In dogs with a surgical or open wound does low level laser therapy increase the speed of wound contracture and reduce the healing time?

Clinical bottom line

Category of research question
Treatment
The number and type of study designs reviewed
Five papers were critically reviewed. Four were randomised controlled trials and one was a case report
Strength of evidence
Moderate
Outcomes reported
Three out of the five studies currently available assessing low level laser therapy to improve wound healing, suggest that low level laser therapy has no beneficial effect on the healing of open or incisional wounds. Of the papers that used statistical analysis, no statistical significance was found in wound surface area over time or tissue histological findings between wounds treated with laser therapy and those who were not. Two papers identified did find decreased wound healing times however the strength of evidence is far poorer for both, with only subjective assessment of the wound in the controlled trial and the other being a case report without control
Conclusion
Currently there is no strong evidence that low level laser therapy increases the speed of wound contracture and reduced healing time. More studies are recommended to provide stronger evidence towards the use of low level laser therapy in wound healing, preferably with a larger population of dogs and with laser settings which are consistent with previous studies for comparison

How to apply this evidence in practice

The application of evidence into practice should take into account multiple factors, not limited to: individual clinical expertise, patient's circumstances and owners' values, country, location or clinic where you work, the individual case in front of you, the availability of therapies and resources.

Knowledge Summaries are a resource to help reinforce or inform decision making. They do not override the responsibility or judgement of the practitioner to do what is best for the animal in their care.

Clinical Scenario

An owner has presented a 2-year-old female Labrador for a routine open ovariohysterectomy. The owner is slightly concerned about the wound after surgery, as her previous dog was very distressed with her spay wound. 2 weeks following her previous dogs surgery the wound still looked red and swollen and the dog was required to wear a buster collar the whole time as she would constantly try to lick it. She would like to know if there is anything that could be done differently to speed up wound healing and stop it looking red and swollen. You have recently seen "therapeutic veterinary laser equipment" being advocated for improved wound healing. You want to know if low level laser therapy will improve wound healing in dogs, and thus be a worthwhile investment for the practice.

The evidence

Five papers in total were examined. One case study, and four randomised controlled studies.

Summary of the evidence

de Braekt et al. (1991)	
Population:	12-week-old, Beagle dogs acquired by the Department of Orthodontics and Oral Histology at the University of Nijmegen. It is not specified where the dogs are from.
Sample size:	30 dogs
Intervention details:	• All dogs had the same premedication and general anaesthetic and aseptic surface preparation, antibiotic therapy and the same unspecified diet. • Control dogs (six) did not have surgery, had tattoo points made in same position as dogs who had surgery. • Dogs with wounds (24) had a central incision made to the hard palate oral mucosa which was closed with sutures, as well as two wounds either side of this which were left open. Multiple tattoo points were placed 1 mm from wound margin at time of surgery as a marker for quantitative measurements. • 12/24 dogs did not receive laser therapy and antibiotic therapy. • 12/24 dogs did receive laser therapy in addition to antibiotic therapy. Laser therapy involved 830 nm wavelength, with 30 MW energy output. Exposure time 22 seconds, and mean dosage over area was 1 J/cm^2. All dogs had laser therapy 3 x a week for a total of 10 treatments.
Study design:	Randomised control trial

Outcome studied:	• Qualitative clinical inspection of wounds every 2 days until healing was complete.
	• Quantitative measurements of wounds under sedation and using digital photography.
	    ○ Wound surface area calculated by measuring distance from wound to standardised tattoo points marked on oral mucosa.
	    ○ Direct measurement of wound surface area taken as well as weekly mean and standard error of the mean, (SEM) of wound surface area.
	• Rate of wound healing was calculated by looking at wound surface area weekly.

Main findings: **(relevant to PICO question):**	• There were no distinct differences reported between the laser therapy and non-laser therapy groups on qualitative appearance. • There was no significant difference ($P>0.05$) in wound surface area reduction between groups. • There was no significant difference ($P>0.05$) in rate of wound healing between groups.

	• All wounds had fully healed by 4 weeks. • Low level laser therapy at the settings used in this study do not have beneficial effects on open or surgically closed wounds in dogs.
Limitations:	• Small study size. • Dogs were young, so movement of tattoo points may be due to mucoperiosteal growth, but they attempted to monitor this with the six control dogs. Did not mention this in detail. • The qualitative assessment of the wounds was not blinded. However, the quantitative measurements of the wounds were performed by two independent blinded observers.

Lucroy et al. (1999)	
Population:	8-year-old male, neutered, client owned Whippet. Had a non-healing wound on right pelvic limb and was presented to the School of Veterinary Medicine at the University of California, Davis.
Sample size:	One dog
Intervention details:	• Pre-existing chronic wound measured with precision callipers, 2.21 cm^2. • Bacterial culture of wound negative. • Wound was bandaged with non-adherent bandages and dog wore an Elizabethan collar the entirety of treatment. • Laser therapy started on day 0, 630 nm wavelength, 20 MW/cm^2 energy output. Exposure time 250 seconds and given once a day for 4 consecutive days and mean dosage of 5 J/cm^2.
Study design:	Case report
Outcome studied:	• Wound size was measured once a day for 21 days using precision callipers and photos were taken with a scalpel handle to act as an internal scale. • Photos were analysed digitally to calculate wound surface area each day.
Main findings: **(relevant to PICO question):**	• A reduction in wound surface area was observed on day 4. • Documented reduction in wound surface area over time via a line graph. No statistical analysis done. • 10 days after completion, wound was 0.1 cm^2 and reportedly completely healed by day 21. • The laser therapy appeared to aid the healing of a chronic non-healing wound in this case.
Limitations:	• This is a case report and as such is low level of evidence. • No statistics were done on this case and there was no direct control comparison. • No mention on whether the dog was on any medications during this time (for the 8 months of non-healing or during the treatment time).

Kurach et al. (2015)	
Population:	Male entire purpose bred Beagles aged 13–18 months acquired by the Department of Small Animal Clinical Sciences and Diagnostic Center for Population and Animal Health in Michigan State University.
Sample size:	10 dogs

Intervention details:	• Dogs acted as their own control
	• Each dog was premedicated and anaesthetised with the same protocol, with the same aseptic preparation of the skin.
	• 2x2 cm^2 full thickness skin defects were produced in four places on the dogs:
	    ○ First wound 5 cm ventrolateral to the dorsal midline and 5 cm caudal to the scapula
	    ○ Second wound 8 cm caudal to the first wound
	    ○ This was done bilaterally on each dog
	    ○ Used a sterilised template to standardise the wounds
	• Each side (two wounds each) was randomly assigned as control wounds which did not receive laser therapy or the laser wounds which did.
	• Laser therapy involved using 635 nm wavelength, 7.5 MW energy output and exposure time was 5 minutes. Dosage was 1.125 J/cm^2. This was started immediately postoperatively and then repeated 3 x a week and repeated until wounds were fully epithelialised.
	• Control wounds were covered with saline soaked gauze during laser therapy to prevent inadvertent laser exposure.
	• All wounds were covered with non-adherent dressing and secured with an adhesive bandage around the dog's body and wore Elizabethan collars for the duration of the study.
	• Bandage changes were done on day 0, 2, 4, 7, 9, 11, 14, 15, 18, 21, 23, 25, 28, 30 and 32. During these changes wounds were photographed alongside a metric ruler.

Study design:	Randomised controlled study

Outcome studied:	• Qualitative analysis of the photographs was done using a standardised scoring form. This was done by a single non-blinded observer.
	• Quantitative analysis was done using 'wound planimetry' which involved digital tracing of the wound photographs to calculate wound surface area. Images were randomised and the technician who took measurements was blinded.
	    ○ Total wound area and open wound area were quantified on each bandage change. The difference was used to calculate "% epithelialisation" of the wound.
	    ○ Total wound area on each bandage change and original wound was used to calculate "% contraction" compared to day 0.

	• In addition to this small biopsies using a disposable dermal biopsy punch were taken on days 0, 4, 7, 11, 14, 18 and 21 at wound edges. • Biopsies were examined histologically by a blinded dermatopathologist and were given a histologic acute inflammation score (HAIS) and histologic repair score using standardised scales.
Main findings: (relevant to PICO question):	• No statistical significance between the laser treated and control wounds in all parameters measured ($P>0.05$); mean total wound area, mean % wound contraction, mean % wound epithelialisation, mean histologic repair scores or mean histologic acute inflammation scores. • All wounds healed by end of the study. • No apparent beneficial effects of low level laser therapy in open wound healing in dogs at the specified laser settings or with the specified technique.
Limitations:	• Small study size. • Possibility that laser therapy has systemic effects. May have influenced the healing of the control wounds within the same animal. • Non-blinded observer for wound scoring adds possibility of bias to this study.

Gammel et al. (2018)	
Population:	Female entire dogs of undisclosed breeds aged 6 months to 5 years obtained from a local humane society in Tennessee.
Sample size:	10 dogs

Intervention details:	• Dogs acted as their own controls.
	• Each dog was premedicated and anaesthetised using the same protocol and had the same aseptic preparation of their skin.
	• Each dog had a bilateral flank ovariectomy performed:
	    ○ A dorsal ventral incision was made midway between the last rib and cranial ilium
	    ○ Wound length was standardised to 10% of the spinous process for each dog
	    ○ Wounds were closed with nylon suture material in an interrupted cruciate pattern
	    ○ 3 cm caudoventral to each wound, a 15 mm punch biopsy was made and left open
	• Each side of the dog was randomly assigned control, or laser therapy. This was after surgeons had created the wounds to avoid bias.
	• The laser therapy involved 980 nm wavelength, 2–3.5 MW energy output and dosage of 5J/cm^2. This was started 24 hours (+/- 1 hour variation) post-surgery and then occurred every 24 hours for 5 consecutive days.

	• Treatment areas varied between dogs as did exposure time (ranging from 1 minutes 33 seconds to 2 minutes) • All wounds, control and laser, were kept covered with a non-adherent dressing between evaluations. • Incision and open wound evaluation were done on days 3, 7, 11 and 14. Photographs of wounds were taken at this time.
Study design:	Randomised controlled study
Outcome studied:	• Blinded qualitative assessment of photographs was done using standardised "subjective wound evaluation sheet" as well as an inflammation score using a modified 4-point scale. • Quantitative assessment was done by taking measurements of the wound photographs using a ruler and included dorsal ventral radius and craniocaudal radius. • Punch biopsies of dorsal aspect of wound were taken on day 7 and ventral aspect of wound on day 14. These were assessed by a blinded external histopathologist who scored slides (0–4 scale) based on necrosis, re-epithelialisation, fibrosis and white blood cells present.
Main findings: (relevant to PICO question):	• No significant difference found in healing time, wound area size or histological changes between the laser treated wounds (incisional and open) vs the control group. • All incisions healed by day 14.
Limitations:	• Small number of dogs. • Variable dog population, breeds, sizes and unknown medical history. • Variable laser treatment areas and exposure times. Likely due to different breeds. • The control wound was not covered during laser therapy so there is the possibility of inadvertent laser exposure during therapy. • Dogs acted as their own control so there is the possibility systemic effects from laser therapy may influence the healing process on control wounds. • Subjective assessment of wound photographs.

Wardlaw et al. (2019)	
Population:	Client owned Dachshunds presented to the College of Veterinary Medicine, Mississippi State University for hemilaminectomy surgery in the thoracolumbar region.
Sample size:	12 dogs
Intervention details:	• Each Dachshund went for surgery to have a hemilaminectomy for a T3–L3 intervertebral disc extrusion. • Wounds were photographed 15 cm away at a 90° angle from dorsal surface. • Photographs were taken of wound on day 0, 1, 3, 5, 7 and 21. • A clinical scar scale was produced, using images from the first three dogs enrolled in the study.

	◦ Score 0 – Fresh surgical incision (Photo taken on day 0) ◦ Up to Score 5 – Completely healed (Photo taken on day 21) • A coin flip, after the first three dogs were enrolled, decided which dog started with laser therapy. Dogs alternatively allocated treatment (n=4) or control group (n=5) as each one was enrolled after this. • Laser therapy involved 850 nm wavelength, covered a treatment area of wound plus margins which was approximately 7.55 cm^2. Dosage of 4 J/cm^2, which was done twice during each treatment, totalling 8 J/cm^2 for each treatment. • Exposure time varied due to different wound lengths of each patient. • Four dogs in the non-laser control group and two in the laser group were on steroids during the study. These were of varying doses which were not specified.
Study design:	Randomised controlled study
Outcome studied:	After the study was complete, qualitative assessment was done. All photos taken were randomly assigned a number and then given to veterinary surgeons not involved in the study to assign a scar scale score (0–5).
Main findings: (relevant to PICO question):	• No significant difference ($P>0.05$) in scar scale scores between laser and non-laser wounds on day 0, 1, 3 or 5. • Dogs who received laser therapy on their wounds had statistically improved scar scales (higher score) on days 7 and 21 compared to the control dogs. • Overall, mean scar score was significantly higher in laser treated wounds vs control. • Concludes that laser therapy accelerates wound healing.
Limitations:	• Small study size. Only three dogs received laser therapy. • No standardisation of wound length, or medications. • One dog in the laser group did not get photographed on day 21, so hard to conclude a statistical significance with only two dogs. • Additional statistics did show that the dogs on steroids had a significantly lower scar scale than dogs who were not. Mostly the control groups were on steroids, which is a potentially confounding factor in this study. • No objective measurements taken; subjective scar scale used with minimal description of wound. • Dogs had varying wound sizes and abaxial muscle and despite observers being blinded, author comments that it was likely they could figure out which dog was which by the photos.

Appraisal, application and reflection

Only two out of the five papers conclude a positive effect of laser treatment on wounds whereas the remaining report no significant difference. Wardlaw et al. (2019) reports improved scar appearance for laser treatment, but was poorly designed with only three dogs treated and wounds assessed subjectively only and lack of standardisation of wound or treatment protocol. The case report by Lucroy et al. (1999) added very little to the weight of evidence and was especially hard to compare to the others as it looked at a chronic wound as opposed to acute wounds. The papers which contributed the most to strengthening the evidence available were by De Braekt et al. (1991), Kurach et al. (2015), and Gammel et al. (2018). All three papers had a good randomised control study design with objective as well as subjective assessment of standardised wounds. While the strongest studies assessed here did reach statistical significance, each study had a small number of dogs and different laser therapy protocols used in each analysis, making it difficult to compare them directly. More control studies preferably with a larger population of dogs and using laser settings from previous studies would be advisable to provide a stronger level of evidence for the effectiveness of low level laser therapy.

Methodology Section

Search Strategy	
Databases searched and dates covered:	OVID Medline® 1946 to 2019 OVID CAB Abstracts 1973 to 2019 Web of Science 1900 to 2019
Search terms:	Medline – ((Low Level Laser Therapy) AND (Wound healing OR Wounds OR Incision OR Open Wound OR Tissue Repair OR Incision OR Wound treatment)) AND (dog OR dogs OR canine) CAB Abstracts – (lasers/ OR laser*.mp) AND (wounds/ OR healing/ OR tissue repair/ OR wound treatment/ OR incision/ OR wound*.mp or heal*.mp OR "tissue repair".mp) AND (exp dogs/ OR dog*.mp or canine*.mp) Web of Science – (Low level laser therapy) AND (wound healing/ OR incision) AND (dogs)
Dates searches performed:	15 April 2019

Exclusion / Inclusion Criteria	
Exclusion:	Articles not related to PICO Journals not available in English Letters, book chapters, review papers Low level laser therapy used in any species other than dogs or for other purposes such as pain relief
Inclusion:	Primary evidence studies in which the effects of low level laser therapy were reported in dogs who received it as a treatment for an open wound or surgical incision.

Search Outcome				
Database	**Number of results**	**Excluded – [does not relate to PICO]**	**Excluded – [review papers, not in English or book chapters]**	**Total relevant papers**
Ovid Medline®	32	26	2	4
CAB Abstracts	169	157	9	3
Web of Science	6	3	0	3
Total relevant papers when duplicates removed				**5**

CONFLICT OF INTEREST

The author declares no conflicts of interest.

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REFERENCES

1. de Braekt, M. M. H. I., van Alphen, F. A. M., Kuijpers-Jagtman, A. M. & Maltha, J. C. 1991. Effect of low level laser therapy on wound healing after palatal surgery in Beagle dogs. *Lasers in Surgery and Medicine,* 11: 5**,** 462–470. DOI: https://doi.org/10.1002/lsm.1900110512
2. Gammel, J. E., Biskup, J. J., Drum, M. G., Newkirk, K. & Lux, C. N. 2018. Effects of low-level laser therapy on the healing of surgically closed incisions and surgically created open wounds in dogs. *Veterinary Surgery,* 47: 4**,** 499–506. DOI: https://doi.org/10.1111/vsu.12795
3. Kurach, L. M., Stanley, B. J., Gazzola, K. M., Fritz, M. C., Steficek, B. A., Hauptman, J. G. & Seymour, K. J. 2015. The Effect of Low-Level Laser Therapy on the Healing of Open Wounds in Dogs. *Veterinary Surgery,* 44: 8**,** 988–996. DOI: https://doi.org/10.1111/vsu.12407
4. Lucroy, M. D., Edwards, B. F. & Madewell, B. R. 1999. Low-Intensity Laser Light-Induced Closure of a Chronic Wound in a Dog. *Veterinary Surgery,* 28: 4**,** 292–295. DOI: https://doi.org/10.1053/jvet.1999.0292
5. Wardlaw, J. L., Gazzola, K. M., Wagoner, A., Brinkman, E., Burt, J., Butler, R., Gunter, J. M. & Senter, L. H. 2019. Laser Therapy for Incision Healing in 9 Dogs. *Frontiers in Veterinary Science,* DOI: https://doi.org/10.3389/fvets.2018.00349

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