

CASE REPORT

Companion or pet animals

Undesired effects of low-level photobiomodulation analgesic therapy in three cats with osteoarthritis

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Email: ca573@cam.ac.uk**Abstract**

Three cats with osteoarthritis undergoing low-level laser therapy showed undesired effects, namely, discomfort and behavioural changes, after their first laser session. Although visible burns could not be detected and rectal temperature was only slightly elevated compared to pre-procedural values, it is hypothesised that the behavioural changes showed by all three cats, namely, restlessness, tail wiggling, flinching away from touch and frequent position changes, were caused by skin overheating, as it has been reported in human patients.

It is advisable to intensify post-procedural monitoring in cats undergoing photobiomodulation as part of the analgesic treatment of osteoarthritis for early detection of complications. Measurement of skin surface temperature of the treated areas and behavioural observation may be recommended in cats following photobiomodulation, possibly until 3–4 h after the end of the laser treatment.

KEYWORDS

feline, laser therapy, osteoarthritis

BACKGROUND

Laser therapy is becoming an increasingly popular method to treat osteoarthritis (OA)-associated pain in veterinary patients. Its use has been documented in both humans and dogs,^{1–5} and while there are no published reports of photobiomodulation therapy in cats, laser devices for veterinary use with programs specific for cats are commercially available to veterinary practitioners.

With this case report, the authors aim at raising awareness of the potential complications of photobiomodulation therapy in cats. It is believed that cats may be more sensitive than dogs and horses to skin overheating potentially resulting from laser therapy and that such skin overheating may cause them discomfort. For early detection of these complications, veterinary pain therapists who treat cats with laser therapy should monitor their behaviour and, possibly, their skin surface temperature during the post-procedural period.

CASE PRESENTATION

A 13-year-old, neutered male domestic shorthair cat with right hip and lumbosacral OA (cat 1), a 17-year-old, neutered male domestic shorthair cat with bilateral hip and lumbosacral OA

(cat 2), and a 12-year-old, female spayed Maine Coon cat with bilateral elbow and right tarsus OA (cat 3) were referred to the pain clinic of a private veterinary practice (Clinica Veterinaria Europa).

The cats lived indoor and their owners reported apathy, decreased activity and behavioural changes such as unwillingness to climb and jump. Previously, all three cats had been treated with oral meloxicam (0.05–0.1 mg/kg Metacam; Boehringer Ingelheim) for up to 10 days without any improvement; by the time of presentation, they were still receiving glucosamine and chondroitin sulphate in the form of food supplements (Confis Ultra, Candioli).

The cats were scheduled for low-level photobiomodulation therapy using a laser device designed for veterinary patients (LaserVet 1000, GlobusVet). The total number of sessions was to be determined, based on the observed effects and response to initial treatment.

The laser probe was applied directly on the skin of the areas to be treated, namely, the affected joints and the associated muscles, which were the iliopsoas muscle for the hip, the gastrocnemius for the tarsus and both the triceps and brachialis muscles for the elbow. A specific feline program was used, with the following variables setting: 600–800 mW range of potency, depending on the coat pigmentation (light or dark); 1 W cm² density of potency; 900 nm laser beam wavelength;

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80 (joints)–3000 (muscles) Hz range of frequency; 2.1 J cm² (joints)–4.1 J cm² (muscles) range of energy; and 3.5 mm spot laser diameter. Both continuous and pulsed emittances were used with an alternate pattern, with cycles of the same duration. The duration of laser exposure ranged from 75 to 148 s, depending on the coat pigmentation. Neither sedation nor clipping of the treated areas was required. The cats were collaborative and friendly during treatment and seemed comfortable in cat wards during the early post-procedural period.

Discharge from the hospital occurred within 1 h from the end of the laser session. The rectal temperatures measured at discharge were only mildly elevated compared to baseline values measured at admission to practice (38.5°C, 38.3°C and 38.8°C vs. 38.3°C, 38.0°C and 38.3°C in cats 1, 2 and 3, respectively). However, within 3 h from the end of the session, all three cat owners independently phoned the practice to report that their cats were showing restlessness, tail wiggling, flinching away from touch and frequent position changes. Cats 2 and 3 also showed spontaneous vocalisation and hissing, which according to their owners was unusual for them, whereas both cats 1 and 2 were subjectively perceived as particularly warm at touch, especially in the areas of the back and base of the tail.

Owing to the impossibility of the cat owners to return to the practice, the cats could not be examined on the same evening of the laser treatment. At the physical examination, which was performed on all the cats on the day after, the cats were in good clinical conditions and neither visible burns nor skin lesions were detected. The rectal temperatures were the same as those at discharge; however, the skin surface temperature could not be measured owing to the lack of appropriate equipment.

INVESTIGATIONS

The diagnosis of OA was confirmed with both radiographic and orthopaedic exams. The skin appeared intact at pre-treatment physical examination, with normal appearance and no visible lesions in all cats. Systemic disorders and clinical conditions other than OA were excluded on the basis of the history, physical examination and blood biochemistry and haematology in all three cases.

DIFFERENTIAL DIAGNOSIS

Cats are prone to stress related to transportation to the practice, handling and treatment, which may present with similar signs. However, it seems unlikely that stress caused the symptoms reported by their owners in the cats in this report, as all the three of them were friendly, collaborative and used to the veterinary practice where they had been brought many times before.

OUTCOME AND FOLLOW-UP

All three cats were discharged from the hospital on the same day of laser treatment. Clinical signs resolved within 4 h from the termination of the laser session in cats 1 and 2; however, the owner of cat 3 reported that mild agitation and unusual behaviour lasted for approximately 12 h.

LEARNING POINTS/TAKE HOME MESSAGES

- Low-level laser therapy may result in undesired effects in cats, such as discomfort and behavioural changes, possibly caused by skin overheating.
- Pain therapists should be aware of the potential hypersensitivity of cats to laser therapy and increase post-procedural monitoring.
- Close observation of the cats' behaviour and measurement of the skin surface temperature before and after the procedure may be advisable as a measure for early detection of side effects.

DISCUSSION

The authors reported the occurrence of undesired effects, presumably thermal skin injury, following low-level photobiomodulation therapy in three client-owned cats diagnosed with OA.

Laser therapy is becoming an increasingly popular method to treat OA-associated pain in veterinary patients. Its use has been documented in dogs^{1–4} and, while there are no published reports of photobiomodulation therapy in cats, laser devices for veterinary use with programs specific for cats are commercially available to veterinary practitioners.

Although visible burns were not detected, the authors hypothesise that, in the cats in this report, laser therapy caused discomfort by transiently increasing the temperature of the skin and, possibly, of the subcutaneous tissues, an undesired effect that is also documented in people.⁶ This hypothesis remains unconfirmed as skin surface temperature could not be measured when the behavioural changes occurred in the cats. Rectal temperature, which was only mildly increased, may not be a reliable indicator to assess localised skin overheating, and neither is the owner's perception, which is subjective in nature and therefore not quantifiable. However, three cat owners independently from each other and without knowing each other reported very similar observations, including abnormal warmth at touch, within the same time window, which seems to support our theory.

Although low-level photobiomodulation is usually regarded as safer than high-level laser emission,⁷ it may still overheat tissues and cause mild burns in animals undergoing treatment, as it is the case for human patients.⁶ Moreover, photobiomodulation is known to have photothermal effects *in vitro*, with the application of the 980 nm wavelength being associated with a >6°C rise in isolated tissues.⁸ It is hypothesised that the frequency of this minor complication of photobiomodulation might be relatively high in the feline population, as it was observed in three out of a total of 10 cats treated by the authors with the same technique.

Further refinement of laser devices with a software specific for use in cats could improve pain therapy in feline patients. Individual variables setting could help pain therapists to adjust treatment to the individual needs of each patient, possibly decreasing the potential for undesired effects. Finally, it may be advisable to measure both skin and rectal temperature before discharge, as a means to early detect this complication

in cats undergoing photobiomodulation therapy. No-contact infrared thermometers may be suitable for this purpose, although the lack of validation of the instrument in the species may be regarded as a limitation.

AUTHOR CONTRIBUTIONS

Loris Barale acquired the data. Loris Barale and Chiara Adami interpreted the data and wrote the paper.

CONFLICT OF INTEREST STATEMENT

The authors declare they have no conflicts of interest.

FUNDING INFORMATION

The authors received no specific funding for this work.

ETHICS STATEMENT

No ethical approval was needed as this case report had no research data. The cats included in this report were client-owned clinical patients; they were treated ethically and received high standard of care.

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OWNER'S PERSPECTIVE

IMAGE QUIZ

MULTIPLE CHOICE QUESTION

Which effects may result from photobiomodulation both in human patients and in vitro?

POSSIBLE ANSWERS TO MULTIPLE CHOICE QUESTION

- a. Rise in surface temperature
- b. Decreased capillary density
- c. Increased thickness of the subcutaneous layers
- d. Increased cellular hydration

CORRECT ANSWER

- a. Photobiomodulation may result in increased skin surface temperature in humans undergoing laser treatment, and in raised surface temperature of isolated tissues in vitro.