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PEMF therapy in the treatment of canine osteoarthritis: preliminary results

S. Pinna, DVM, PhD, A.M. Tribuiani, DVM, E. Pizzuti, DVM, A. Venturini, DVM
Clinical Veterinary Department, Alma Mater Studiorum, University of Bologna, Ozzano Emilia (Bologna), Italy

INTRODUCTION

The purpose of this study is to evaluate the analgesic and anti-inflammatory effects of the pulsed electromagnetic field (PEMF) in the treatment of osteoarthritis (OA) in dogs.

The effectiveness of the PEMF therapy has been demonstrated by several experimental and clinical studies. In fact, while it is widely used in humane field¹, up to now, as far as dogs are concerned, only a few physical therapy reports have been published^{2,3}.

PEMF employs low frequency non-ionized athermic pulsed electromagnetic fields. It is assumed that, due to its interaction with the membrane channels, PEMF alters the transport of ions, like calcium, and causes a consequent modification of the membrane potential. This induces the fall of transduction signals which stimulate the synthesis of growing factors, important for bone and cartilage formation^{1,4}. PEMF chondroprotective action is both direct, by means of homeostasis and articular metabolism modulation, and indirect due to its anti-inflammatory properties.

Some trials demonstrated that PEMF increases chondrocytes proliferation and extracellular matrix components synthesis, while reducing OA progression^{5,6}.

Its anti-inflammatory properties are mediated by an agonist activity on adenosin receptors as well as by an inhibition of prostaglandines synthesis⁷.

PEMF analgesic effect could either be the result of a direct effect on the brain waves, or a consequence of its capacity to affect the endogenous and exogenous opioids system⁸.

Furthermore, PEMF increases blood circulation and tissues oxygenation, and reduces pain, edema and hematoma¹.

MATERIALS AND METHODS

For this study, only dogs that had had lameness for at least four weeks were chosen. It was also required a radiographic evidence of OA in one or more joints. Other factors of exclusion were: systemic diseases, infectious arthritis, pregnancy, and treatments with anti-inflammatory drugs in the last two weeks. Owners were informed about the clinical survey as well as the physical and therapeutic characteristics of PEMF. They were asked to sign an informed consent, stating their obligation to bring their dogs to the veterinary hospital at least 3 times per week, for a total of 20 sessions. Besides, owners were asked not to give any anti-inflammatory drugs, nor to change their dogs dietary and environmental habits, and to report any health problems which might occur during the study period.

For this purpose, 20 dogs of different breed -10 male and 10 female- were enrolled. The mean body weight±SD was 24.68±13.74 kg (range, 5.5 to 50 kg), the mean±SD age was 7.3±4.3 years (range, 9 months to 17 years). The OA joints were 27 (11 elbows, 8 knees, 5 hips, 2 shoulders and 1 carpus).

Lameness, pain on manipulation and palpation, and range of motion were evaluated at the beginning of the therapy (T0), at the tenth session (T10), at the end (T20), and re-evaluated after 4 and 12 months.

Radiographic exams at T0 and T20 were taken, to score the OA signs. At the same time questionnaires were submitted to the owners for the assessment of chronic pain and its impact on their dogs health-related quality of life on the basis of behavioral changes⁹ and the PEMF therapy level of satisfaction.

Follow-up included clinical and radiographic examinations and questionnaires 4 and 12 months after treatment. Scoring was based on a scale of 0 (normal) to 4 (severe) for each variable, except for pain recorded as yes/no, and range of motion recorded as increased/decreased compared with contralateral joint.

Dogs were lain on a pulsated magnetic field mat with cyclic frequency (3-22-250-500-750-1000 Hz) and 0.75 microT intensity for 10 minutes, and then a small pad was applied on the affected joint for 8 minutes.

RESULTS

The percentage of dogs with lame that improved by at least one grade was 85% at T10 and 90% at T20 (18 dogs out of 20) (significantly $P<0.05$). There was pain on manipulation on 77.8% (21 joints out of 27) at T0, it was so on 14.3% (3 joints out of 21) at T10 and on 9.5% at T20. The range of motion scores were improved on 18.5% (5 joints out of 27) at T20. The radiographic signs of OA were scored in all dogs (mean 3 ± 1.04) at T0, but were not significantly ($P>0.05$) improved at T20 (2.96 ± 1.09).

At 4 months all 18 dogs had maintained the benefits recorded at T20. At 12 months 11 dogs were examined, two of them (18.2%) showed lameness and pain. No significantly x-ray changes ($P>0.05$) were recorded. The owners reported improvement (vitality, appetite, lameness) in 45% of dogs at the 5th session. At T0 the owners questionnaire score was 1.07, at T10 it was decreased to 0.80, and at T20 it was significantly ($P<0.05$) improved to score 0.59. The owners' satisfaction was scored 0.43 (0=high satisfaction, 4=unsatisfaction). No adverse effects were recorded during the treatment.

CONCLUSION

The majority of the dogs improved with PEMF treatment with respect to their baseline lameness and pain values, and this was already obvious at half therapy. The benefits were maintained for medium-long time without using anti-inflammatory drugs.

We suppose that a mechanical block from osteophytes, recorded on x-ray films, could be the reason of the lack of improvement of the range of motion.

It must be noted that immunohistochemistry trials on Guinea Pigs showed that PEMF treatment preserves the morphology of articular cartilage and retards the development of osteoarthritic lesions^{5,6}. In contrast with what expected in the present study, the radiograph signs of OA were not decreased probably because 20 sessions were not sufficient to observe any x-rays changes of bone and cartilage.

The results of questionnaires indicated that the decrease of pain impacted positively on the dogs health-related quality of life, and on their owners' high grade of satisfaction.

Double-blind, randomized, controlled studies of comparison between NSAID and PEMF efficacy could be a topic for further research.

In conclusion, PEMF is a non-invasive remedy, lacking in adverse effect, easy to employ, and useful for controlling pain and inflammation associated with osteoarthritis.

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