

Gonarthrosis case study

by Barbara Bockstahler

Every patient who is to undergo physiotherapeutic treatment must be considered as a whole in order to avoid isolated therapy that focuses only upon the ill part of the body. A successful therapy, never limited to a single part of the body, takes into account related secondary problems as well. It is the aim of this article to train the veterinarian to make a comprehensive assessment of the patient in order to benefit fully from the therapeutic potentials of physical medicine.

Symptoms and history

Golden Retriever, male, 5 years, 41.7 kg.

The dog was presented in September 2002 in the surgical and ophthalmological hospital of the Vienna university on account of a chronic lameness of the right rear limb.

An examination of the gait revealed a 2nd degree lameness of the supporting left rear leg.

The orthopedic examination revealed a positive 2nd degree cruciate ligament problem of the right rear leg and medial muscular atrophy of the thigh musculature of the same limb.

The X-ray substantiated a suspected chronic instability of the frontal cruciate ligament, a gonarthrosis (fig. 1) and a low-grade formation of lumbosacral steps (fig. 2).

The diagnosed rupture of the frontal cruciate ligament was treated with a lateral supporting strap modified in accordance with Gretchen Flo. A month after the operation the dog bore its weight well on the hind limb concerned.

Nine months later the dog was again presented to the hospital on account of lameness.

Diagnosis

The clinical examination revealed a lameness of the right rear limb, noted especially after getting up, and also a periarticular fibrous thickening of the knee joint of the same limb.

Attempting to stretch the knee joint resulted in pain and thus a cruciate ligament test could not be done. Flexing and stretching of the knee caused low-grade frictional noise.

The X-ray revealed progressive gonarthrosis in a suspected acute attack (fig. 3).

Physiotherapeutical / orthopaedic examination

Results

u Gait / posture:

Showing mixed first and second-degree lameness on the left hind limb, the patient placed his foot cautiously. There was also a diminished stretching of the knee joint just before he attempted to lift his leg.

Review of methods

Transcutaneous Electrical Stimulation

Within Transcutaneous Electrical Stimulation, a distinction can be made between Transcutaneous Electrical Nerve Stimulation (TENS) and Electrical Muscle Stimulation (EMS).

TENS: The Gate-Control-System theory developed by Melzack and Wall laid the foundations for this technique that is used most frequently. Together with the blocking of ascending nerves and in this way the sensation of pain, it is the increased release of endorphins (e.g. β -endorphins) that adds to the pain-relieving effect. Indirect effects on pain control are muscle relaxation and improved tissue circulation (massage-like) that are associated with TENS. Chronic pain causes non-physiological movement patterns and postures which in time result in partially high-grade muscular tenseness producing secondary pain. Transcutaneous Electrical Stimulation can not only bring about pain relief directly (Gate-Control-Theorie, endorphins) but also indirectly by relaxing muscles and improving the blood circulation in the ill part.

Electrode technique: In order to achieve the therapeutic effect a corresponding application of electrodes is required. In principle, alternating current electrodes are used, and for optimum results those with alternating polarity so that the current flows from electrode A to electrode B and vice versa from B to A. This is an important requirement for a treatment without side effects. The device (PT2000 by S+B medVET) used on our patient fulfils these requirements. The optional methods for applying the E-Pads are as follows:

- ~ The most frequent placement of the electrodes is on the borders of the painful area. One of the two electrodes can also be placed on the most painful spot. It is important to cause the current to flow through the painful area (local therapy).
- ~ Placement of the electrodes on the same myotome, dermatome or sclerotome in such a way that the current flows longitudinally through the area (segmental therapy).
- ~ Trigger or acupuncture points can be treated directly.
- ~ Peripheral nerve stimulation – the electrodes are placed over the nerve fibre.
- ~ Above the spinal ganglia close to the vertebral column.



Fig. 1: Knee, right side: Stress photo with Tibia compression test. Close to the femoral crests and on the base and apex of the patella, bony outgrowths are visible that are chiefly sharply delimiting and up to 2 mm high. Tender bony outgrowths are visible along the femoral crest, on the cranial tibial plateau approximately at the height of the beginning of the cruciate ligaments as well as in the sulcus extensorius. Immediately on the cranial side of the eminentia intercondylaris a small shaded area of 6 x 1.5 mm of low calcium density is visible that might represent a partial rupture of the frontal crucial ligament. The right knee joint gap clearly shows increased filling.



Fig. 2 : Lumbar and sacral spinal column, latero-lateral position. The process articularis cranialis of the sacrum juts out shortly dorsal of the caudal-dorsal vertebral edge of L7. This results in a clearly visible formation of a step of the segment L7/S1 by almost 3 mm with L7 shifted dorsally

The dog showed a slight kyphosis in the area of the lumbar spinal column. The ill limb bore weight only for a short-time.

u Palpation and judgment of the limbs

Knee joint: The joint showed no increase of heat and palpation of the joint revealed neither fluctuation nor swellings of the surrounding soft tissue.

The thigh musculature seemed slightly atrophied in comparison with the contra-lateral side. The cranial portion of the M. quadriceps femoris showed clear hardenings, which were also pressure-sensitive. The caudal-medial musculature and the M. gastrocnemius showed comparable results.

u Mobility of the joints

The range of motion was slightly reduced in the stretching direction.

u Palpation of the spinal column

Lumbosacral transition: Palpation was slightly painful in this area, the musculature revealed clear hardenings here as well.

Interpretation of the results

The above-mentioned results of joint mobility are not to be judged as a result of the primary gonarthrosis problem. Prior to the interpretation of the gait and musculature palpation, information about the muscles in motion is required. Every step consists of two phases: the hanging leg and the standing leg phase. The standing phase is further subdivided into the paw initially hitting the ground, supporting the weight, pushing up and lifting the paw off the ground.

EMS (electric muscle stimulation) is a further form of therapy depending on an electrical device for the stimulation effect. The most important indications are prophylaxis but also treatment of muscle atrophy.

The most effective treatment is by individual pulses via manual programmes. The therapy starts with the vibration pulse programme and, as soon as the animal tolerates more intense stimulation, should change to the percussion and finally the kneading pulse.

Application of the E pads: Apply close to the origin on the afflicted muscle or muscle group (flexor or extensor): **Never treat flexors and extensors simultaneously!**

The frequency must be so adjusted that the temporal sequence of the individual contractions is speedily carried but without the risk of a spasm. The intensity setting is similar to the TENS treatment. A medium treatment intensity producing good contractions should be set for hemi- or tetraplegic patients with limited sensitivity on one or several limbs. Pulse modulation should not be activated at the same time because it might impair the effectiveness of the treatment. As EMS increases the physical strength in the area of the musculature but seldom stamina, it makes sense to combine EMS with stamina exercises such as swimming or running through water or up-hill.

The treatment duration for both forms of electrical stimulation treatment is 10-15 minutes per treatment unit with a maximum of 2 - 3 treatment units a day. In general, an initial treatment of once or twice a day is sufficient which can usually be reduced to once a day or every second or third day. The indications include painful conditions with orthopaedic and neurological causes, muscle atrophies, and pareses. The treatments can be post-operative in a rehabilitation context or as an alternative to surgical intervention if surgery is objectionable or not possible for various reasons.

Thermal therapy

Hot packs and infrared lamps heat superficial tissue to depths of 1-2 cm and longer application durations cause more deep-seated structures to be warmed through conduction.

Local application leads to hyperemia which reduces pain and muscular tenseness. The stretchability of ligaments, tendons and joint capsules is improved. An indication arising from this is application before physical training to warm up and to prepare joints for passive and active motion exercises.

The Cryo or cold therapy reduces the local blood flux by vasoconstriction of superficial vessels. This reduces inflammation symptoms and pain conditions. The application of cold packs is helpful for joints with increased temperatures and on painful areas after the training.

For both forms of therapy, commercial hot-/cold packs are best suited. The required temperature can be reached in the microwave or in the refrigerator. The application should never be carried out directly on the skin: The packs are first wrapped into cloths and then applied. The application durations are 15 to 20 minutes 2-3 x a day or – depending on the desired effect – before and after training.

Massage

Non-physiological loads and pain conditions frequently produce obvious tenseness of the musculature which can be treated with massage. Muscles that respond best to massage are primarily the long back musculature, the thighs, the shoulder area as well as the upper arm.

Effects of the massage:

- The noticeably increased blood circulation in the skin and the structures underneath achieves improved oxygen supply and a more effective removal of metabolic products.
- Congestions in the vein and lymph area are counteracted.
- Regulation of the muscle tonus: tonus reduction of tense musculature or respectively tonus increase of limp musculature.
- Improved regeneration of tired musculature.
- Dissolution of scars and adhesions
- Pain reduction through release of body endorphins and improved removal of pain-inciting substances.
- Improved bodily sensation.
- Psychic relaxation.
- Not proven but there must be a positive effect from the intensive care of the owner for the pet.

Indications: Illnesses of the motion apparatus, spinal cord syndromes, arthroses and post traumatic conditions.

Neurological ailments: Pareses, sensibility ailments

Contraindications: Local inflammations of the skin, tumors, feverish illnesses, tendency to bleeding, circulation decompensation

Special muscles are involved in every phase of a step. In pushing the body up, the mm. glutei stretching the hip joint, the m. quadriceps femoris stretching the knee joint and the m. gastrocnemicus as the extensor of the ankle joint play the fundamental roles.



The above mentioned extensors muscles are aided by the buttock muscles (m. biceps femoris, m. semitendinosus and m. membranosus) which are involved in initiating momentum for the act of motion.

In our case the clinically ascertainable changes of this musculature are connected with the inactivity atrophy but also explain the deviations in the gait of the animal.

The painful back musculature has presumably two causes: On the one hand there is a primary problem from the lumbosacral step formation, on the other hand, continued lameness over a long period and disturbed motion can secondarily produce tenseness of the back musculature.

Physiotherapeutic measures

Aim of the physiotherapy

The therapy for the above patient focussed on the following points:

- Effective pain reduction while avoiding medicament therapy
- Improvement in the joint function
- Muscle rebuilding
- Improvement of secondary symptoms (back musculature)
- Weight reduction

Treatment plan

As explained above, the problems of the patient cannot be considered in isolation from each other. So a highly effective therapy management for the animal must be found that is

Fig. 3: Knee, right side (checkup): Torn cruciate ligament was treated with an external cruciate ligament substitute. Laterally, two shaded tubular metal density areas about 7 x 4 mm in size are visible. In the tub. tibiae area 2 lighter areas about 1 mm in size are visible – these are drilling channels. The calcium density formations noted in the area of the apex and base of the patella and along the rolling crests, have increases in comparison with the previous X-ray picture and show more irregular shapes. Furthermore, there are calcium density formations up to 3 mm high in the area of the ligament humps and in the area of the proximal tub. tibiae that look irregular in shape. The knee joint appears filled.

The shadow of soft tissue in the area of the lig. rectum patellae looks clearly widened.

accepted by the owner and makes sense economically for both the owner and the veterinarian.

Here is a basic rule: Use every necessary therapy form but do not employ too many different methods. Otherwise one would risk overtaxing the animal and the owner, lose track of the effectiveness of each of the methods (not every animal responds equally well to each method) and and have difficulty keeping the time expenditure within acceptable limits.

The physiotherapeutic/orthopaedic examination

- Examination of the gait and posture
The animal is examined stepping and trotting but its ability to climb stairs, to get up from lying and the like have to be taken into account as well. Attention is to be given to compensatory movements of the animal. Among the factors to be considered beyond the afflicted limb are its way of walking including the posture of the head and neck, the back line, and its way of moving the rest of its limbs.
- Palpation and judgment of the limb
From distal to proximal, the examination not only includes the joints, but also the long bones. Painfulness and increase in size are to be judged. The surrounding soft tissue is examined for atrophy, pain, change of complexion, temperature and consistency.
- Examination of the mobility of the joints
This is done in the physiological axes while the corresponding proximal joint is being fixed. The range of motion is examined along with the degree of pain, crepitus, size increase and fluctuation.
- Palpation of the vertebral column

u Primary pain alleviation for the afflicted limb

2 times a week, transcutaneous electrical stimulation treatment with the PT 2000 unit (S+B medVET, www.submedvet.com), programme 5, pulse modulation activated, with electrodes applied medio-laterally (fig. 4 + 5). This mode is simple to use and can be administered by the animal owner without problems (fig. 6, 7, 8).

Handling: In principle, the area to be treated should be warmed up beforehand with the hot packs for about 10 minutes for additional optimisation of the treatment success. Before applying the E-pads, the skin must be moistened with water or alcohol for optimum coupling. Then the E-pads are to be brushed into the fur with light pressure so that there is a good skin contact. The position of the E-pads is finally secured with the elastic velcro strip.

The respective programme is selected (programme 1-5, no individual frequency setting required).

Optimum intensity setting: The device is slowly energized and the power is checked (signal on the display) and slowly increased

until the threshold is just exceeded where the animal shows the first response. The typical indicator is salivation resulting in licking or swallowing but also sudden turning of the head to look around, nervousness etc.

The intensity of the pulse should then be reduced by 2 steps. As soon as the animal's salivation stops (after about 10-20 seconds) the pulse intensity can be increased to the threshold value just below the initial response value. This is the optimal treatment strength for the respective patient.

Pulse modulation: This option is to be activated with all treatment indications in the context of TENS. While delaying habituation, it improves the subjective feeling of patient. The choice of the suitable programme automatically determines the appropriate pulse mode sequencing as well as burst and break phases including the respective optimum frequencies.

If the device is to be lent to the animal owner, a treatment plan has to be drawn up beforehand

which clearly defines the programme, the intensity and the treatment intervals. The form enclosed with the PT2000 can be used for this purpose.

u Relief of secondary symptoms

Massage

Simple massage grips can be taught to skilful owners without problems and should be carried out at home several times a day. The following was recommended for the Golden Retriever:

Begin the massage on the back and continue on to the legs using strokes (fig. 9) which means applying both hands flat on the musculature and passing over the back and legs with gentle pressure.

When this manual treatment has grown on the animal, the pressure can be increased carefully. Kneading can then be done where individual muscle groups are selected and worked upon between both hands.

Circular motions are used with thumbs, fingertips or ball of the thumb over the musculature in the area of the back musculature.

Thermal therapy

Cold: Many patients with Gonarthrosis show a marked increased feeling of heat of the joint concerned and this is noted particularly after exercise.

Cold packs should be used here. Commercial products are to be wrapped into a cloth and put on the heated joint for 10-15 minutes. The owner who is to carry out this therapy at home is to be trained appropriately.

Heat: Before every massage and also before walks, the back and thigh should be treated for a warm-up with a red light lamp or hot packs.

Red light lamps should be placed at a distance of approximately 30-40 cm from the animal. Hot packs are applied in the same way as cold packs.

Thermal therapy and massage were carried out by the owner at home, the electrical stimulation treatment was in this case only applied in the clinic, but can in principle also be assigned to the owner for home treatment without problems. This is particularly advisable if the animals have to be treated daily or the animal owner travels a long way to the veterinarian or the clinic.

u Weight reduction

This represents an essential factor in the treatment of animals with ailments of the motion apparatus. Impellieri et al.

(Impellieri JA, Tetrack MA, Muir P): Effect of weight reduction on clinical signs of lameness in dogs with hip osteoarthritis. J Amer Vet Med Assn 2000; 216: 1089-1091) shows that weight reduction could lead to a significant improvement in cases of lameness by 11-18 %.

Our patient received commercial energy-reduced food as a prescription. 60% of the caloric equivalent required for maintenance was fed. The aim was a loss of 1 % of the weight per week. The targeted weight of 36 kg was to be achieved after 6 months.

Development with physiotherapy treatment

At first the dog showed some discomfort in electrical stimulation

treatment. This could be remedied by a small reduction of the intensity. Altogether 21 treatment sessions were carried out with the PT 2000.

In the course of this treatment period, the lameness first improved clinically by one degree. Finally the dog showed no more clinically visible lameness after normal exercise, enjoyed movement a lot more and could get up considerably better.

Manipulation of the knee joint was no longer painful, and the range of motion had improved. The targeted weight was achieved. During the entire therapy no analgesics were used.



Fig. 4: Medial and lateral position of the E pads. It is important that the current can flow through the painful area and the needle electrodes are not placed directly on bone points. If the musculature should already be largely atrophied in this area, the E pads can be also placed on the musculature above and below the knee so that the current running between them can flow through the joint i.e. diagonally: One E-pad on the thigh medially, the other one on the lower leg laterally or reversely, depending on where a good amount of musculature is still present. The small E pads should be used with marked atrophy.



Fig. 6: Medial-lateral application of the E-pads on the knee and fixation with a stretch band.



Fig. 5: Pre-heating of the area to be treated for 10-15 minutes with hot packs (not too hot! Wrap in a cloth if necessary)



Fig. 7: Intensity set-up: As soon as the threshold value is just exceeded, the animal starts to salivate which can be inferred from the animal licking its snout.

Dictionary

Range of Motion

The range of motion describes the limits of movement of a joint. It is determined by stretching and bending the joint up to the point where the patient shows discomfort. It is advantageous to measure the maximum angle by means of a goniometer. This instrument is to be applied at the pivot of a joint with the shanks precisely placed in the bone axis without being displaced during measurement. The measured values can also be used for reproducible evaluation of the therapy success (JaegerG, Marcellin-Little DJ, Levine D): Reliability of goniometry in Labrador Retrievers. AJVR, Vol 63, No 7, July 2002, 979-996).

Segmental therapy

Owing to segmental relatedness in the organism, one component within a structure never responds alone by itself. For example, an irritation of the viscerotome is led as an afferent information via the related segmental part of the neurotome to the dorsal horn of the spinal cord. After switching over to the efferent branch a contraction of the myotome occurs via neurotome and somatic and viscerosympathic fibres. The sclerotome is connected through the muscular forces in the origin and base area.

The richly innervated sensitive periosteal insertion area responds by hypersensitivity and pain. The angiotome undergoes vasoconstriction through the sympathetic system which leads to insufficient

supply of the dermatome. This malnutrition resulting from lack of oxygen increases the turgor of the skin.

All mentioned structures are not only triggers but can also provide diagnostic clues and therapeutical targets.

Myotome (muscular segment portion), dermatome (skin segment portion), sclerotome (bone segment portion), viscerotome (organ segment portion) are linked with each other via the angiotome (segmental vessels) and the neurotome (nerve segment).

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Here are some internet links to the Publisher of the original article

www.veterinary-medicine.net
www.parey.de
www.der-veterinaer.de

Further information about the PT2000 unit (transcutaneous electrical stimulation therapy) on the internet: www.submedvet.com (click!)