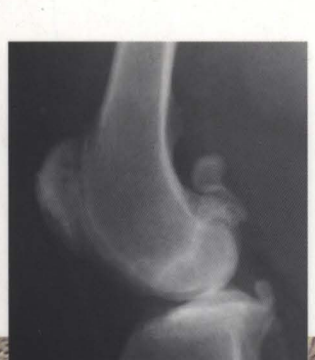
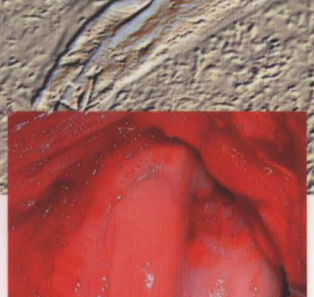
Diagnosis and treatment of joint diseases





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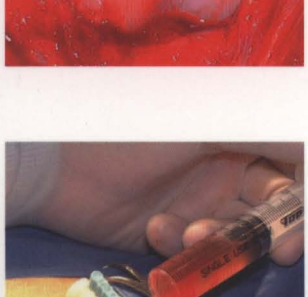

Masahiro Okumura

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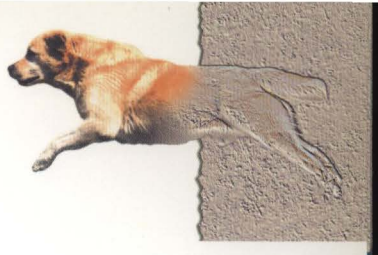

Diagnosis and treatment of joint diseases of small animals

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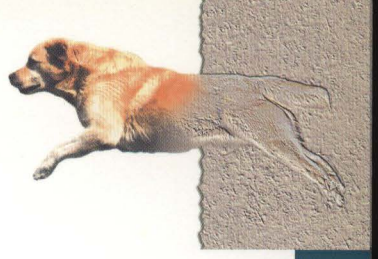
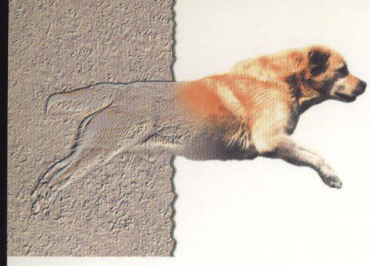
Contents





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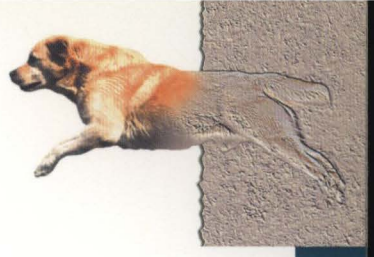
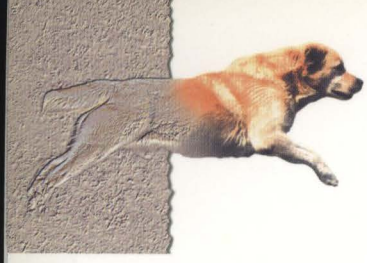


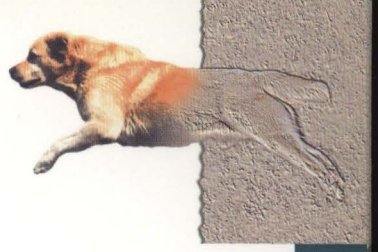
Introduction

1

Today, small animal clinicians encountes dogs and cats suffering from joint diseases more frequently than before. This is due to the increase in life expectancy of the animals and the current trend of people having medium to large breeds of dogs, which are more likely to develop joint disorders, as pets. Quite often veterinarians find it difficult to accurately diagnose and treat joint diseases because of the particular functional characteristics of joints.

In this article, the outline of the methods of diagnosing and treating joint diseases of small animals are described.





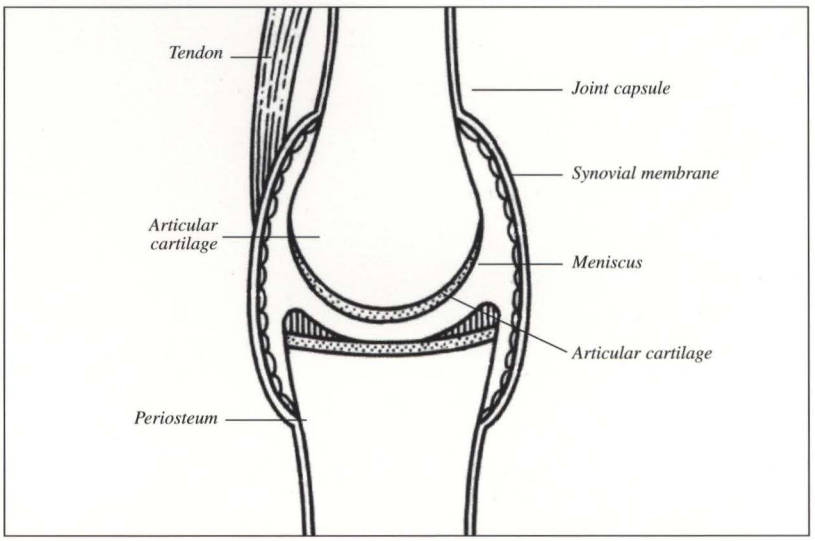
Structure and function of joints

2

Structure and function of joints

The joints of the limbs are regarded as synovial joints with a synovial membrane, normally containing synovial fluid (joint fluid). The opposing epiphyses of the bones that form joints are connected together by a connective tissue membrane. Its outer layer is the joint capsule, with a tough ligament-like structure, which is continuous with the periosteum. The inner layer of the capsule is the synovial membrane, which secretes and metabolizes the synovial fluid that fills the articular cavity. The synovial membrane also controls the cartilage matrix metabolism through synovial chemical mediators. Hyaline cartilage covers the articular surfaces of the bones that constitute the joints. In addition, menisci (articular discs) made of fibrocartilage are present between articular surfaces of the facing epiphyses in some joints, such as knee joints (Fig. 1).

Fig. 1 - Structure of a joint



Source: Hirohata, K., Terayama, K., Tsuji, A. (1993): Hyojun Seikei Gekagaku (Standard Orthopedics), 5th edition, Igaku Shoin, Tokyo

Articular cartilage consists of cartilage cells and a large amount of cartilage matrices produced from the cells. It does not have blood vessels, nerves or lymphatic tissues. Nutrients are transferred through the synovial fluid. About 80% of the cartilage matrix is water, and the rest of it consists of collagen(12%), proteoglycan(2%), and other substances. The biochemical characteristics of the cartilage matrix have an important role in absorbing the impact of shock in the joint and its lubrication system. The cartilage matrix comprises elastic tissue having a collagen skeleton and proteoglycan that controls the water content. Proteoglycans have an unique structure in which a number of monomers are bound to hyaluronic acid chains (Fig. 2).

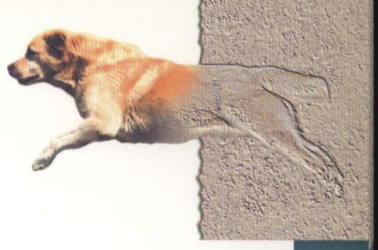
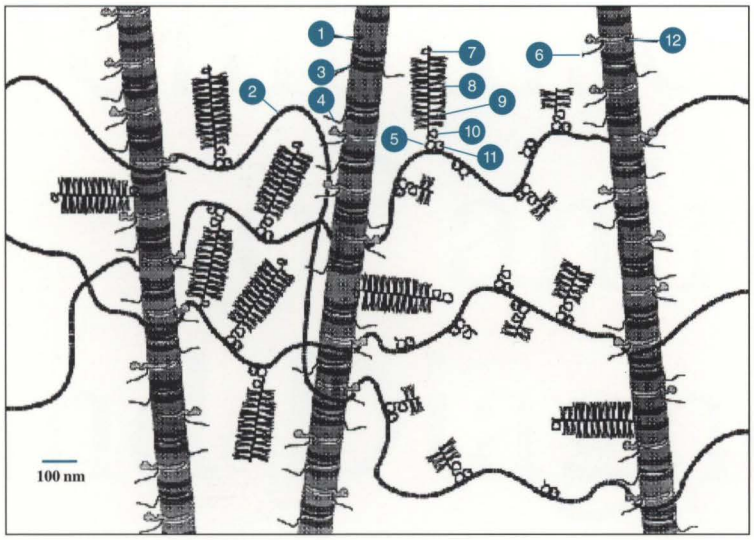


Fig. 2 - Structure of the cartilage matrix

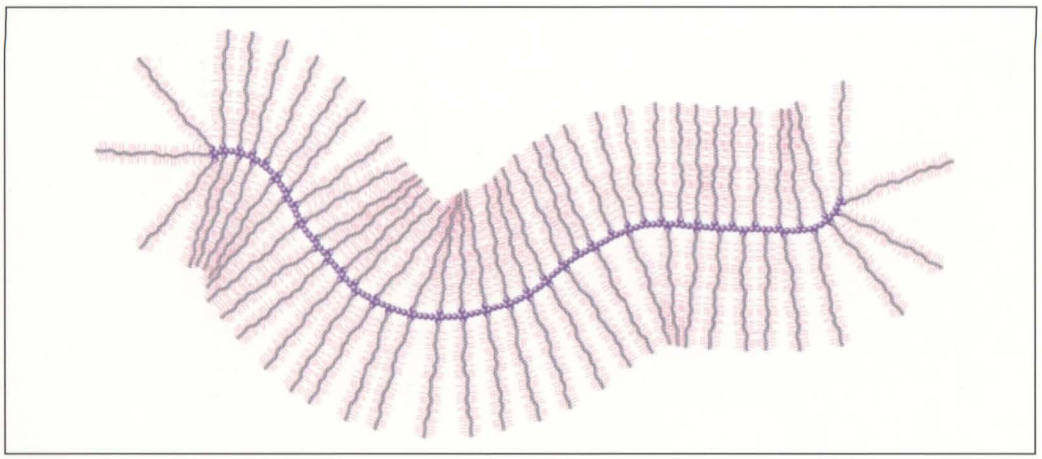


1. *Type II collagen fibre*
2. *Hyaluronic acid*
3. *Decholin core*
4. *Dermatan sulphate*
5. *G1 domain*
6. *Chondroitin sulphate*
7. *G3 domain*
8. *Chondroitin sulphate*
9. *Keratan sulphate*
10. *G2 domain*
11. *Link protein*
12. *Type IX collagen*

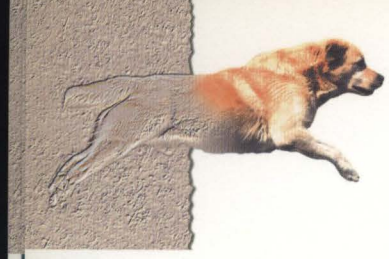
Source: Reference 3
McIlwraith, C.W., Trotter, G.W. (1996): Joint disease in the horse., W.B. Saunders, Philadelphia, USA.

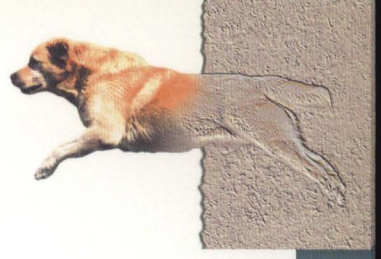
The proteoglycan monomers have a brush-like structure in which a number of chondroitin sulphate chains, which are the main components, and keratan sulphate chains are connected to protein, which connected to the hyaluronic acid chain (Fig. 3).
The matrix is metabolized and controlled by the cartilage cells and the balance between its anabolism and catabolism is being maintained in healthy joints.

Fig. 3 - Proteoglycan monomer



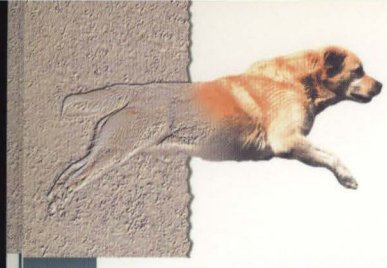
In animals having joint disease, the homeostasis of cartilage matrix metabolism breaks down, and the characteristics of the matrix are being lost, causing lowering of viscoelasticity and loss of the low friction characteristics of articular cartilage, eventually leading to degenerative diseases such as **osteoarthritis (OA), or degenerative joint disease (DJD).**





Joint diseases of animals and Diagnosis

3



Joint diseases of animals

Joint diseases of small animals can be, based on their causes, classified into two categories; inflammatory diseases and non-inflammatory diseases.

. The causes of inflammatory joint diseases are very varied :

> Immune-mediated factors,

> Microbial infection,

> secondary effects of trauma.

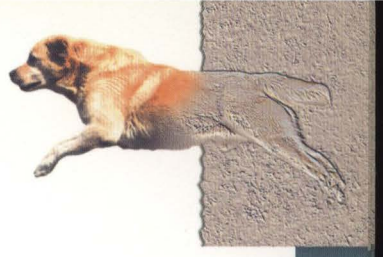
Currently, more than 300 such causes have been listed in the medical literature.

. Non-inflammatory joint diseases include disorders such as :

- **osteoarthritis**, osteoarthritis caused by the degeneration with age of joint structures, such as cartilage,

- **osteoarticular dysplasia** that occurs during the growth phase, such as dysplasia of hips.

Although no proper epidemiological survey has been carried out in Japan, joint disorders caused by osteoarticular dysplasia during the growth phase are found in large-sized canine breeds such as Retrievers or others. On the other hand, joint diseases caused by ageing affect most canine breeds and are particularly common in Shetland Sheep dogs.



Diagnosis of joint diseases

Joint diseases are diagnosed with the help of

1) general physical examination,
2) examination of lameness,
3) orthopaedic evaluation,
4) examination of the synovial fluid,
5) diagnostic imaging.

1 - General Physical Examination

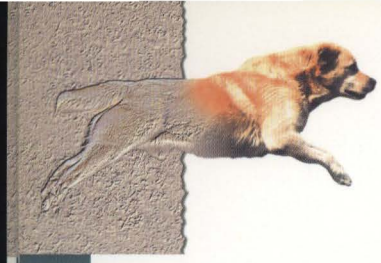
The first step in diagnosis is to interview the owner to obtain a record of the history of the animal's disease. Age, sex, breed (for signalment) and vaccination history form the basic data. In addition, information on the home environment and the reasons for why the animal is being kept are to be collected. The final objective of the therapy differs depending on whether the animal is kept as a pet, as a working dog, for exhibition, or for racing.

Table 1 - Points to be kept in mind while interviewing the owner for diagnosing joint diseases

1. Differentiate the pet owner's opinions about the conditions their pet is in from the ones given from an objective perspective.
2. Onset of the disease: Was it sudden or gradual?
3. The period for which the animal has been suffering from the problem and the progress of the disease.
4. If the symptoms appear intermittently, when do they appear and are they cyclic?
5. Movement of the animal: Is it autonomous? Does the animal move together with other animals? What is the extent of movement?
After interviewing the owner, carry out a medical check, an examination of the gait, and neurological tests on the animal.

The history of the animal and the period spent with the current owner also constitute important data. If the animal grew with the present owner from birth, it may be possible to find out the condition of its siblings. In the case of animals required to perform certain kinds of work or participate in races, the disease may be related to changes in rearing environment.

Information about the current disease should then be collected from the owner. Information provided by the owner would become very useful in diagnosis if an abnormal gait is the main complaint, and especially when there is intermittent lameness or if the extent of lameness changes. The points mentioned in Table 1 should be kept in mind while interviewing the owner.



2 - Examination of Lameness

While examining animals for lameness, it is important to determine whether the cause lies in the musculoskeletal system, nervous system, or elsewhere.
For inspecting the mode of lameness, firstly, examine the attitude of the legs.
Secondly, while observing the animal, have the animal walk towards you, and also have the walk away from you.
Have the animal walk slowly, trot, run and jump.
In some cases, it may take some time for the lameness to appear.
The major points to be observed are the strides of each foot and whether all joints are moving normally under loading.

3 - Orthopaedic Evaluation

Orthopaedic examination is undertaken if the cause of the lameness is suspected to be in the musculoskeletal system. In orthopaedic examination, the first step is to understand the data collected by questioning the owner. It is also necessary to take the diseases that are most frequent in animals of that age, sex and breed into account. Observing the gait of the animal as explained above and its posture while standing also form part of orthopaedic evaluation.

Have the animal stand still and check whether there is any muscle atrophy in the legs.
Also, check muscle reactions, and whether the animal feels pain along the spine at the neck or the back, and whether there is any fibrosis around any joints.

Secondly, palpate to identify joints, bones, ligaments and tendons that have pain, swelling or instability (Table 2).

Table 2 - Points to be kept in mind during palpation for diagnosis of joint diseases

1. Is there any anatomical abnormality or displacement (luxation or subluxation)?
2. When does the animal show signs of pain?
3. Is there any restriction in the range of motion of any leg or joint?
4. Is there any crepitus?
5. What is the condition of the soft tissues that support the joints, such as the collateral, dorsal, palmar and cruciate ligaments of each joint?

If the animal limps, palpate all the legs in the distal to proximal direction, and then, examine presences of pain, joint mobility, and the extent of swelling in order to identify the abnormal part. If a joint has some disorder, there may be swelling because of an increase in the amount of synovial fluid. This can be determined by pressing on the joint (Fig.4). No sedative or analgesic should be given until this stage is completed because the animal's reactions need to be observed.

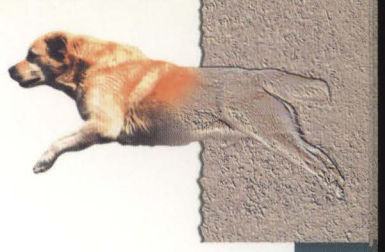


Fig. 4-1
Palpation of the elbow joint

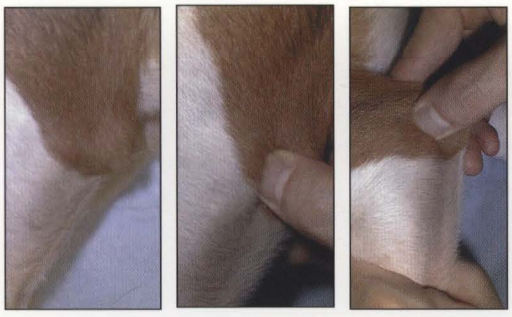


Fig. 4-2
Palpation of the knee joint

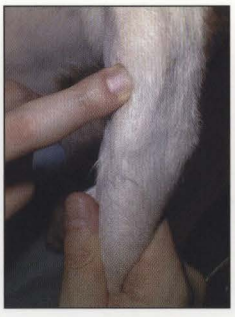
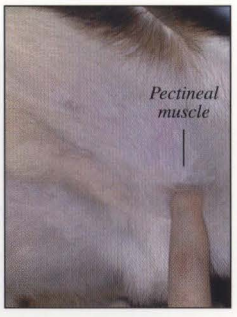


Fig. 4-3
Palpation of the hip joint



Next, carry out biodynamic tests on the joint after immobilizing the animal with a sedative or an anesthetic. The sedated animal will not show any signs pain, therefore, it is necessary to identify the abnormal joint before sedating the animal.

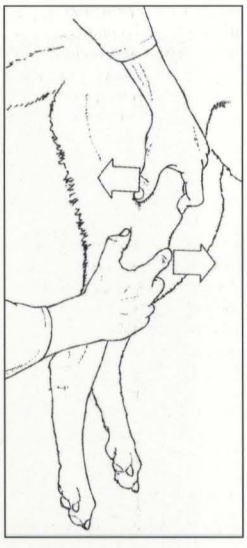
The stability of the joint is examined by manipulation :

> to elicit the cranial drawer sign in case of anterior cruciate ligament rupture of the knee joint (Fig. 5),

> the Ortolani sign (Fig. 6) used for evaluating stability of hip joints having dysplasia,

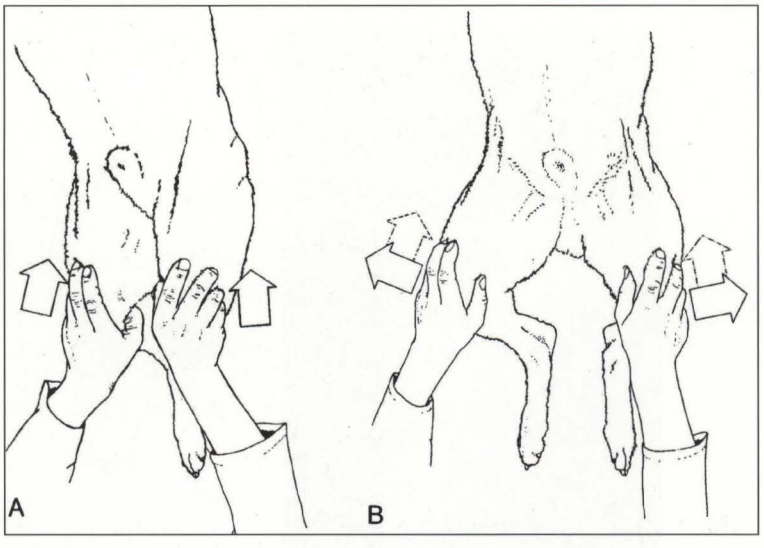
> the Barden sign can be detected.

Fig. 5 - Detection of the drawer sign



Book Reference 4. Whittick. W.G. (1990): Canine Orthopedics., Lea & Febiger, Philadelphia. USA.

Fig. 6 - Detection of the Ortolani sign



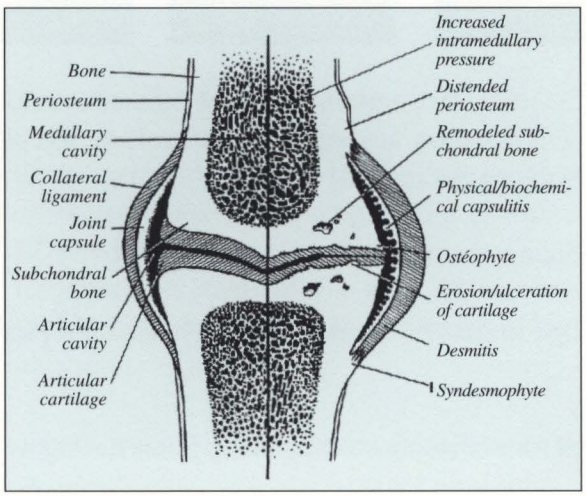
Source: Reference 4. Whittick, W. G. (1990): Canine Orthopedics. Lea & Febiger, Philadelphia, USA.

Aside from examining the stability of the joint, one has to also determine whether the joint has crepitus. This is an important clue in diagnosing instability or damage of the joint structure, such as intra-articular fracture, or arthrophyte (a joint mouse).

4 - Diagnostic Imaging

Imaging can be an important auxiliary technique in diagnosing joint diseases. Simple x-ray examination, arthroscopy, x-ray CT, MRI, or ultrasonography can be used for diagnostic imaging. However, we have to keep in mind that in the case of joint diseases the images obtained in this manner do not always show the current problem only. Therefore, it is necessary to balance the images obtained through the history with the findings of the physical examination, and the results of orthopaedic evaluation.

Fig. 7-1 - Changes in joint structure caused by joint disease



Source: Reference 3
McIlwraith, C.W., Trotter, G.W. (1996): Joint disease in the horse., W.B. Saunders, Philadelphia, USA.

Fig. 7-2 - OA of elbow joint
(fragmented medial coronoid process of ulna)

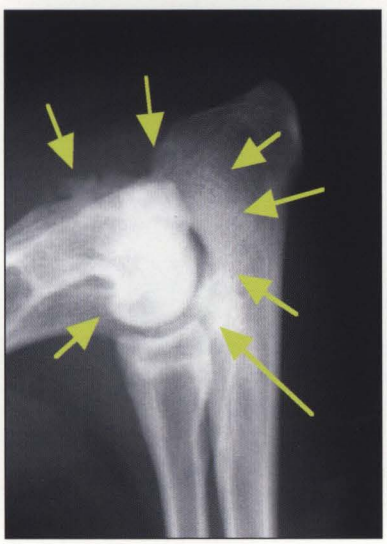
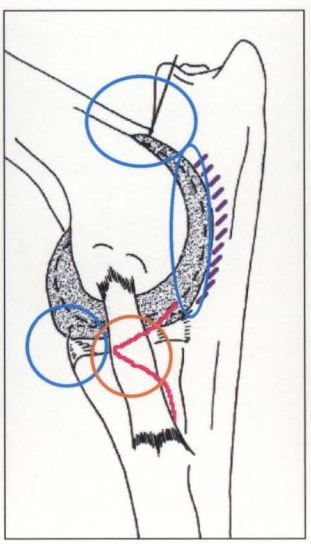
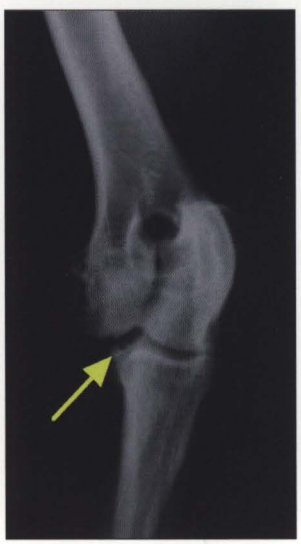


Fig. 7-3 - OA of elbow joint
(remodeling of the subchondral bone)





Reference 4
Whittick, W. G. (1990): Canine Orthopedics., Lea & Febiger, Philadelphia, USA.

Fig. 7-4 - OA of hip joint

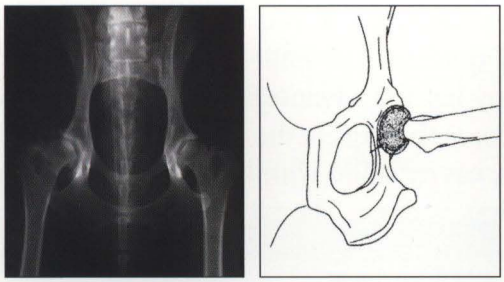
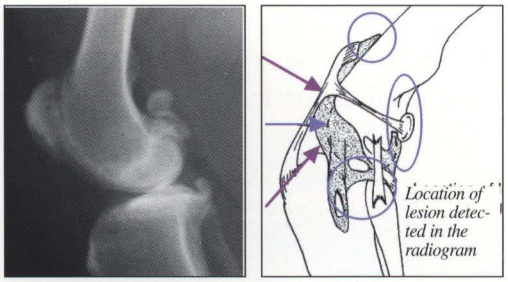


Fig. 7-5 - OA of knee joint



Source: Reference 4 Whittick, W.G. (1990): Canine Orthopedics., Lea and Febiger, Philadelphia, USA.

1 - Radiographic examination

Radiographic examination is the most widely used and important confirmatory diagnostic test for various diseases.
Radiography can be used to :
- evaluate the state of the bones in the joint,
- detect calcification (osteophyte, enthesophyte, or others) around the joint,
- indirectly estimate the amount of synovial fluid (by observing the shifting of the joint capsule and adipose tissue),
- evaluate the swelling of soft tissues around the joint (Fig. 7).

The items listed on Table 3 should be considered while radiographic examinations are conducted. Except for joints showing clear signs of dislocation or instability, or when there is a fracture in or around the joint, the radiographic findings must be interpreted taking the clinical findings (results of general physical and orthopedic testsexaminations) also into account, for evaluating chronic deformation of joints. Although when an animal shows an unnatural gait, radiography should never be used just to "try to detect the abnormality by radiographic examination of all the joints of all four legs."

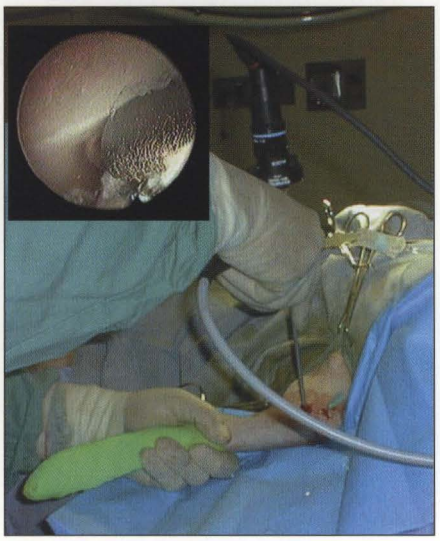
Table 3 - Points to be kept in mind in x-ray examination of joints

1. ***There is often a considerable time gap between the onset of the disease and the stage when the lesions can be detected by radiography.***
2. ***Not all lesions detected by x-rays may be directly related to the current disease.***
3. ***Whether the x-ray images are the ones that were taken using acceptable methods should be taken into account..***
4. ***Survey radiography is usually not useful for diagnosis of joint diseases, such as osteoarthritis in particular.***

2 - Arthroscopy

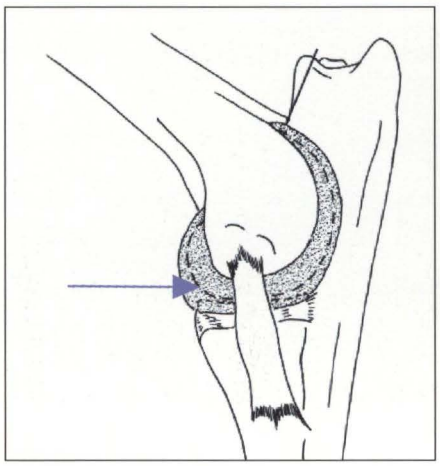
Arthroscopic devices have been improved and miniaturized in recent years, and arthroscopes are being used for diagnosis and treatment of joint diseases of small animals. Apart from being less invasive, arthroscopy has the advantage of allowing in vivo observation of structures inside joints. Arthroscopic findings in the synovial membrane and the articular cartilage surfaces in the articular cavity filled with synovial fluid are often different from those obtained when arthrotomy is done. The fact that detailed observations can be made in vivo by arthroscopy is a significant advantage in the diagnosis of joint diseases (Fig. 8).

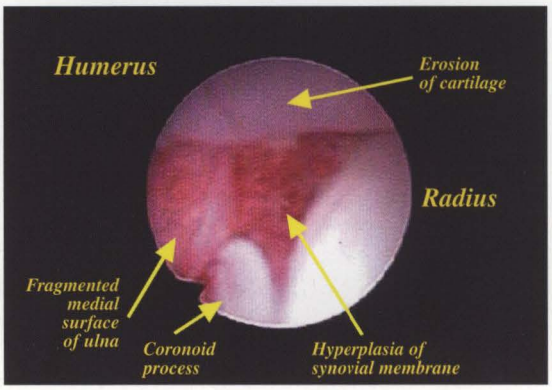
Fig. 8 - Arthroscopy of the elbow joint



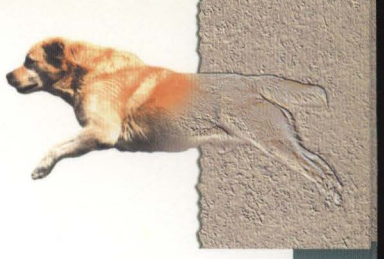
Arthroscopy and arthroscopic surgery are currently used for excising and removing osteocartilagenous parts affected by osteochondritis dissecans (osteochondral fragments) (Fig. 9),

Fig. 9 - Fragmented medial coronoid process of the ulna





Reference 3 McIlwraith, C. W., Trotter, G. W. (1996): Joint disease in the horse., W. B. Saunders, Philadelphia, USA



> for taking biopsy samples of inflamed synovial membrane (Fig. 10),

> for observing ligaments, tendons, synovial membrane and articular cartilage inside the joint (Fig. 11).

Fig. 10 - Inflammation of the synovial membrane

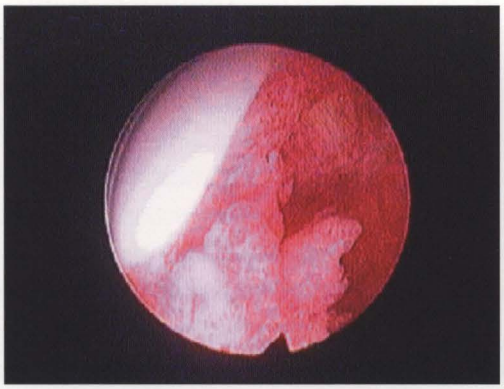
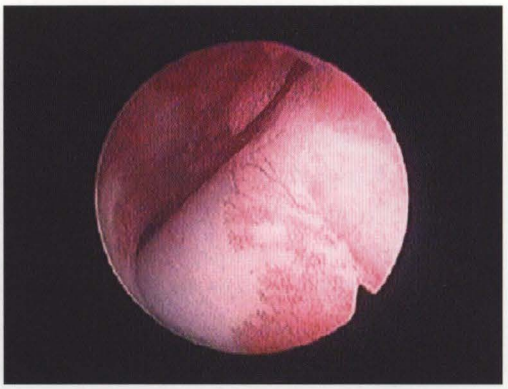


Fig. 11 - The biceps tendon in the shoulder joint



3 - Tomographic imaging (x-ray CT, MRI, ultrasonography, or others)

It is difficult to observe the three-dimensional structure of a joint through simple radiography. Thus, tomographic imaging of joint structures is regarded as an important measure for improving the accuracy of the diagnosis. Such modern techniques as x-ray, CT, and MRI have begun to be used for diagnosis of joint diseases of small animals. The effectiveness of these methods by which lesion can be observed without interference from overlapping bones and their usefulness in diagnosing several diseases of the hip joints or elbow joints have been reported (Fig. 12).
In some cases, the lesion can be easily observed in the computer reconstructed three dimensional image (Fig. 13).

Fig. 12 - X-ray CT image of a fragmented medial coronoid process of the ulna

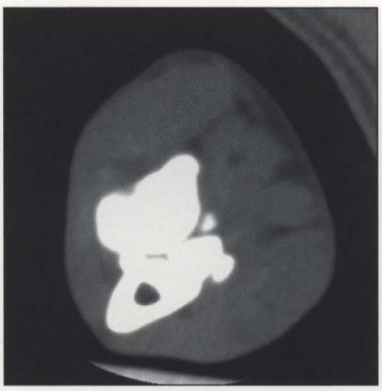
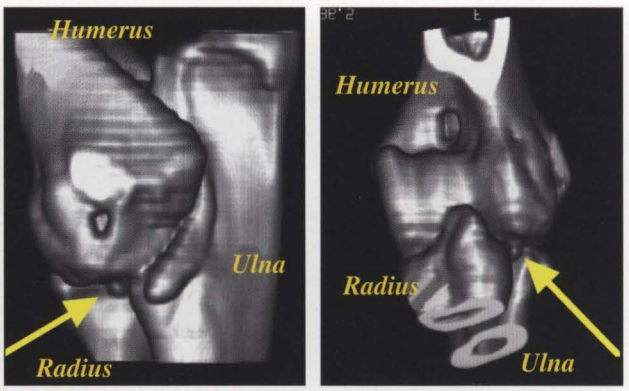
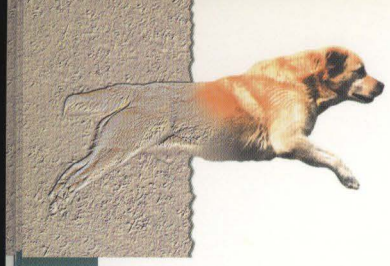


Fig. 13 - X-ray CT 3-D image of a fragmented medial coronoid process of the ulna



X-ray CT is excellent in detecting calcification while MRI can show an image of even soft tissues like cartilage and tendon. These techniques are now used in human medicine to diagnose joint diseases. However, their clinical use has not yet become routine for



small animals because they are presently expensive, require deep sedation or anesthesia, and still have problems with the resolution of the images obtained.
Ultrasonography is also being carried out on joints. It has been found useful in detecting lesions of meniscus and ligaments. However, ultrasound cannot pass through calcified areas, so the acoustic window will be extremely small for the joints of small animals, and therefore, it is not currently considered as a practical examination.

5 - Tests on synovial fluid

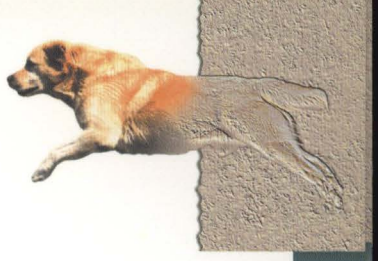
Examining synovial fluid is not a commonly used procedure in a diagnosis and treatment of joint diseases in small animals. However, since the information obtained from the synovial fluid reflects the conditions within the joint, it is quite effective in detecting and evaluating infections, neoplasia, and inflammation, which are potential causes of morbid changes. A 22-25G needle and an approximately 2 ml syringe are used for puncturing the joints of small animals. The reason for using a syringe of this size is to avoid loss of fluid when puncturing--only a very small amount of synovial fluid is normally obtained when puncturing--, and also to ensure the negative pressure necessary for suction. When a large amount of synovial fluid is to be sampled and tested, anticoagulation treatment with EDTA or heparin becomes necessary.

The parameters that can be tested using the synovial fluid are listed in Table 4.

Only a small amount of synovial fluid as a sample can be taken when puncturing a normal joint. For instance, the amount of fluid is only about 0.01 to 1.0 ml even in case of puncturing in large joints of dogs. If the amount of fluid sampled is much less than what was estimated by palpation, this could be an indication of the formation of fibrin or pannus (granular tissue formed on the articular surface because of inflammation) in the joint.

Table 4 - Particulars analyzed using the synovial fluid

1. The amount of synovial fluid
2. Appearance: Colour, transparency and viscosity
3. Cytological analysis: Cell morphology and cell count
4. Protein content
5. Bacteriologic culture test: anaerobic and aerobic
6. Others (mucin, glucosesugars, joint markers, anti-nuclear antibodies, rheumatoid factors, etc)



Appearance

Normal synovial fluid is transparent or has a slightly yellowish colour. Reduced transparency suggests bleeding in the joint or an increase in the cell count. A coloured supernatant of the synovial fluid suggests chronic intra-articular bleeding. The viscosity of the synovial fluid is evaluated visually at the time of its sampling. If the viscosity is to be compared, the fluid should be preserved after heparin is added so that it can be tested at the same time as other samples are tested. The viscosity of the synovial fluid generally decreases when there is inflammation of the joint.

Cytological analysis

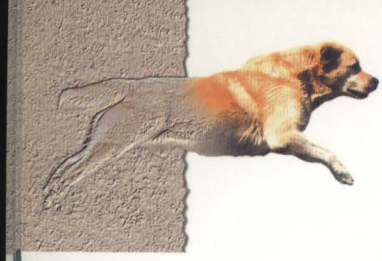
Normal synovial fluid hardly contains any cells except for a few nucleated ones. It is considered that the cell count differs depending on joints, and the nucleated cell count is generally less than 3,000/μl of synovial fluid. When a much higher cell count is expected, the cells must be counted after diluting the sample with physiological saline. Acidic diluents should not be used because they may coagulate the mucin in the synovial fluid. The nucleated cells are mostly lymphocytes and large monocytes, with very few neutrophils. The neutrophil count, however, may be higher if there is inflammation in the joint. One can predict the type of morbidity in the joint by observing the morphology of the neutrophils when there is an increase in their count. Infectious joint disease produces toxic effects such as chromatic agglutination and granulation in neutrophils.They have near-normal shape when the joint disease is immune-mediated. If cells of abnormal shape are found in the synovial fluid, one should suspect a tumour, etc. or other disease.

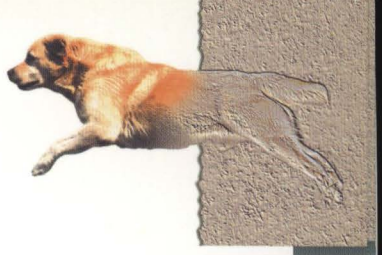
Protein content

It has been reported that the protein content of normal synovial fluid taken from canine shoulder, carpal or knee joints is 2.0-2.5 g/dl. The protein content can be determined with a refractometer. The amount of the protein content increases according to severity of joint inflammation, showing the level of value close to the one found in blood plasma.

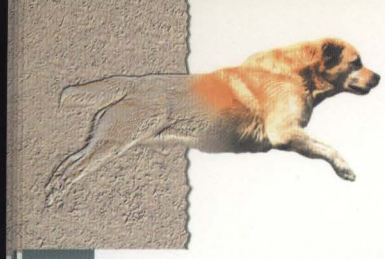
Bacteriological culture test

Culturing synovial fluid or tissue is done for both aerobic and anaerobic bacteria, for detecting bacterial infection in a joint. Gram staining of the synovial fluid is often useful for a tentative diagnosis of bacterial infection before the results of the bacteriological culture are received. Even if the results of bacteriological culture test prove negative, other tests should be carried out when other findings suggest infectious arthritis.





Treatment of joint diseases



Treatment of joint diseases

Joint disorders are treated through conservative treatments or surgery. One of the major problems found in joint diseases is cartilage damage caused by primary and secondary diseases. As discussed earlier, it is important to maintain cartilage matrix metabolism in order to have the joint function retained. Once the cartilage is damaged by trauma or joint inflammation, it will take a long time to heal. The primary goal of the treatment of joint disease is to repair articular cartilage and restore joint function. Treatments of osteoarthritis in the main, methods of treating joint disease and some points to be kept in mind during a treatment shall now be discussed.
The administration of drugs alone is not sufficient to treat osteoarthritis. Drug therapies need to be combined with mild exercise and weight control for fast restoration of the functions of joints. In some cases, an underlying disease may have to be treated, or surgery may be required.

1 - Conservative Therapy

The ultimate goals of conservative therapy should be :

> to remove the cause of the joint disease,

> to control the pain in order to improve the animal's quality of life,

> to repair the cartilage that has been damaged by the disease.

Plans for therapy can include weight control, management of exercise, and medication.

Non-drug conservative therapy

The physical build of an animal with joint disease should be evaluated, and its diet should be suitably changed so that the animal will have an appropriate, or even a slightly lower, body weight. It is recommended that animals with osteoarthritis should be prohibited from doing work or strenuous exercise and, instead, be allowed to do some mild exercise on a daily basis. This is to maintain the range of motion of the joint, to strengthen soft tissues around the joint, and to enhance metabolic activity in the cartilage by mild loading.

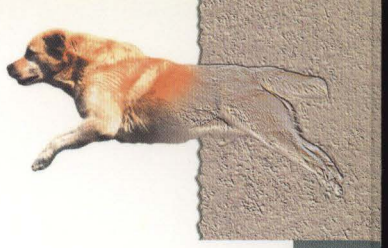
Drug therapy

Purposes

The expected effects and the points to be kept in mind while treating osteoarthritis with drugs can be summarized as follows:

- Control of pain

A pain caused by joint disease not only lowers the animal's quality of life but also induces inflammatory mediators in the joint. It has been pointed out that this aggravates the disease. Pain control is, thus, an important part of the management of joint



disease. However, if the pain is reduced rather unnecessarily, the animal may become too active, and then the affected joint may become overloaded.

- Control of joint inflammation

Inflammation in the joint, of the synovium in particular, elicits the release of biochemical mediators that accelerate the degeneration of the articular cartilage and redirect the balance of cartilage metabolism in a direction that would destroy the cartilage. Therefore, it is important to control inflammation in the joint.

- Correction of degraded joint structure

There are no drugs that can remove the osteophytes or reverse changes in periarticular structures. Also, no drug can directly repair damaged cartilage. Therefore, auxiliary treatment is to be given in order to prevent further damage in the joint structure. Also, surgery may also be needed in some cases.

- Modification of cartilage matrix metabolism

The onset of joint disease alters the metabolic balance of the cartilage matrix and adversely affects its biodynamics, allowing the advancement of osteoarthritis. DMOA (Disease-Modifying Osteoarthritis Agents) containing chondroitin sulphate, glucosamine, hyaluronic acid, or other drugs, are presently drawing much attention as medications that may suppress the decomposition of cartilage matrix and promote its formation.

Practical aspects of drug therapy

Medication is an important method of treating osteoarthritis that requires maximum caution. Since long-term use of drugs is usually necessary in animals with osteoarthritis, drugs with minimum side effects are preferred. NSAIDs (non-steroidal anti-inflammatory drugs), steroids, and DMOAD may be a choice of the drugs used in order to achieve the purposes mentioned above.

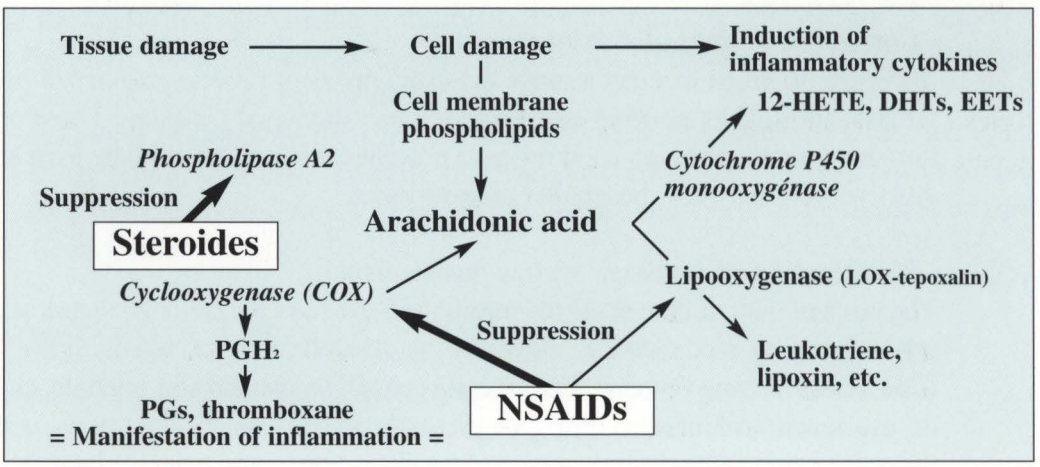
Steroids and NSAIDs

The most commonly used drug therapy for canine joint disease at present is the administration of steroids or NSAIDs.

Steroids effectively alleviate symptoms temporarily, and intra-articular administration of steroids may be effective for rapid suppression of acute synovitis in an early stage. However, it certainly inhibits the physiological mechanisms that are necessary in healing process of joint structure. While the symptoms are temporarily reduced, progressive articular disintegration occurs steadily in the background (Fig. 14). Therefore, steroids must be used only after careful consideration, except in such a case that a temporary alleviation of the symptoms is desired, or in case that it is considered difficult to use NSAIDs on cats. NSAIDs have the effect of relieving inflammation by inhibiting the arachidonic acid cascade via cyclo oxygenase (COX) (Fig. 14). There are two types of COX on which NSAIDs act. These are COX1, which is physiologically necessary, and COX2, which causes problems at the time of inflammation. Unfortunately, none of the NSAIDs presently available can specifically inhibit COX2 alone (Fig. 15). Thus, no NSAIDs can eliminate their side effects on to the digestive tract, the kidneys and other organs. Meloxicam, carprofen, etodolac and nimesulide have been developed as NSAIDs that

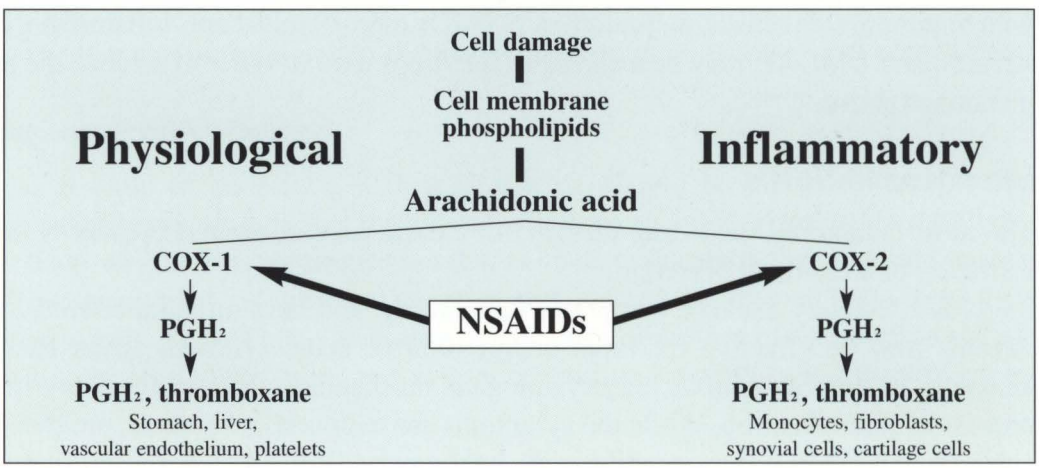
have some specificity towards COX2 and ready for use in veterinary practice. These NSAIDs can be administered over a longer period than the existing NSAIDs such as aspirin, flunixine or other drugs. They are considered to improve veterinary drug therapy for osteoarthritis. However, we have to remember the facts that these new NSAIDs also have side effects and have little direct effects on healing of damaged cartilage.

Fig. 14 - Mechanism of manifestation of inflammation and the action of steroids & non-steroidal anti-inflammatory drugs (NSAIDs)



Source: Reference 2 Johnston, S.A. (1997): "Osteoarthritis", Veterinary Clinics of North America, Small Animal Practice 27(4)., W.B. Saunders, Philadelphia, USA.

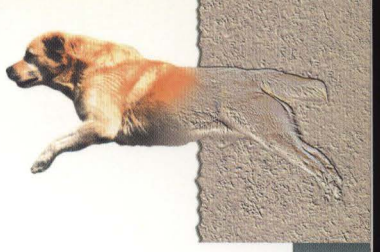
Fig. 15 - Action of cyclooxygenase (COX) and non-steroidal antiinflammatory drugs (NSAIDs)



Source: Reference 2 Johnston, S.A. (1997): "Osteoarthritis", Veterinary Clinics of North America, Small Animal Practice 27(4). W.B. Saunders, Philadelphia, USA.

Disease-Modifying Osteoarthritis Agent(DMOA)

Presently, DMOA are gaining importance in both human and veterinary medicine as drugs for treating osteoarthritis. It has been shown through basic studies that these new drugs can prevent and repair cartilage damage whereas NSAIDs provide "passive" symptomatic therapy that alleviates the symptoms and delays the advancement of the disease.



Hyaluronic acid has been reported as one of the DMOAs in use. In humans, when hyaluronic acid is injected into the cavity of a joint afflicted by osteoarthritis, symptoms such as joint pain are empirically alleviated for a relatively long time (several months) after a series of injections.

It has been reported recently that similar results to hyaluronic acid injections can be achieved by orally administering chondroitin sulphate or glucosamine. These substances are characterized as health foods rather than drugs. Therefore, all over the world, many patients with osteoarthritis are taking them regularly. Similar products have been developed for the treatment of joint diseases of small animals, and some reports on their efficacy have also appeared. Currently, various experiments are underway in different laboratories to clarify the mechanism of manifestation of these effects. We have also obtained generally good results when we used these substances on osteoarthritic dogs.

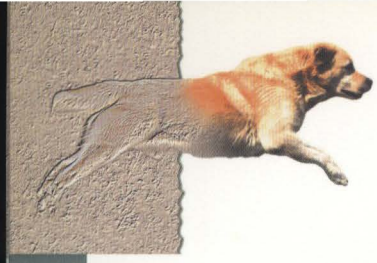
These substances are currently believed to inhibit the advancement of arthritis and assist in the healing of articular cartilage.

- Formulations of hyaluronic acid and polysulphated glycosaminoglycans are being used in veterinary practice for direct injection into the joints or as subcutaneous, intramuscular or intravenous injectables.
- Chondroitin Sulphate and Glucosamine are being given orally. These substances have been shown to bring about clear improvement in clinical symptoms of joint diseases. *In vitro* studies have shown that they also have anti-inflammatory and cartilage protecting effects, through inhibition of inflammatory mediators in addition to a cartilage repairing effect.

The greatest advantage of using these substances in treating osteoarthritis of animals is that they are apparently free of major side effects. The possible side effects are a heparin like action or a glucose loading effect because of the sugar chains contained in them. However, no significant effects of either type have been found up until now. This finding can be of great advantage when these substances are to be given to animals with osteoarthritis that require life-long treatment to maintain a certain quality of life.

Hyaluronic acid

A certain degree of care is needed in the administration of hyaluronic acid into the joints of small animals. As discussed in the section on diagnosis, the articular cavities of small animals have a fairly small capacity. If an excess of hyaluronic acid is injected into the cavity, it can cause pain. If it were to leak around the joint, it could cause periarthritis. Intra-articular injection of hyaluronic acid in small animals can be done relatively safely only when the injection is done into the shoulder, elbow, hip and knee. In most cases, the injection of hyaluronic acid improves the environment within the articular cavity, and therefore, anti-inflammatory and cartilage protecting effects can be expected. The dosage and duration of administration must be decided while monitoring the alleviation of symptoms. One can expect to see improvement after several injections at an interval of 1-2 weeks. Intravenous administration of hyaluronic acid has now become a part of clinical practice in horses. It is considered that the intravenously administered hyaluronic acid is effective because it reaches the joints and also increases the amount of this acid being produced endogenously. However, certain aspects of clinical intravenous



administration of hyaluronic acid, such as the effect of the formulation's viscosity, are not yet well understood.

Polysulphated glycosaminoglycans

Products containing polysulphated glycosaminoglycans are currently administered intramuscularly in treating joint diseases of small and large animals. Fairly extensive research has been carried out on this substance, and it is widely used at present in the clinical management of mild to moderately severe joint disorders. It can be certainly administered through injection. However, since it is presently not considered to be an oral drug, pet owners have no means to provide their pets with it at home. The rough treatment guideline is to administer it once or twice a week, for the period of 4 weeks.

Conclusion about DMOA

Many DMOA products, including those containing chondroitin sulphate, glucosamine and green-lipped mussel extract are now available. The basic effects expected from these products is a cartilage healing action through the supply of raw materials for cartilage matrix formation. Generally, the effectiveness of these formulations becomes clinically apparent several weeks after the start of their use. Veterinarians, therefore, should consider using them along with another drug such as an NSAID for the initial treatment in order to quickly improve the quality of life (QOL) of the animal. Although interactions between NSAIDs and DMOAs are not fully understood, it is generally agreed that NSAIDs that do not have a negative effect on cartilage metabolism can be used in combination with a DMOA.

2 - Surgical Treatment

A surgical procedure is selected, often as the last resort, when joint functions cannot be restored and the control of pain becomes almost impossible. Such surgery includes replacement arthroplasty, arthrodesis and arthroplasty. Because replacement arthroplasty uses artificial materials, it is currently used only for the treatment of hip joint of large dogs. Basic studies on the use of artificial elbow joints in dogs are underway and arthrodesis has been undertaken on many types of joints.

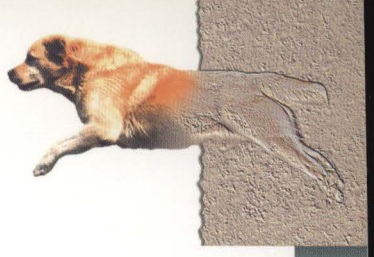


Fig. 16-1 - Immune-mediated polyarthritis

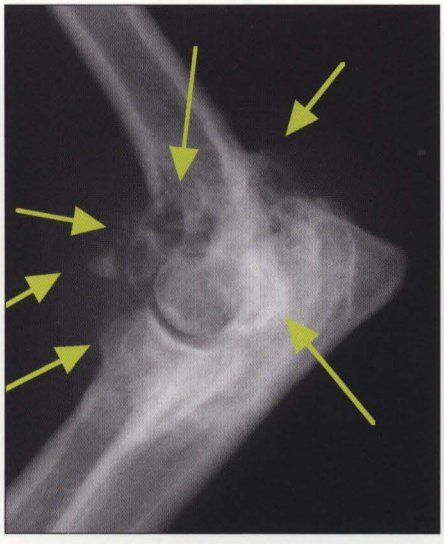
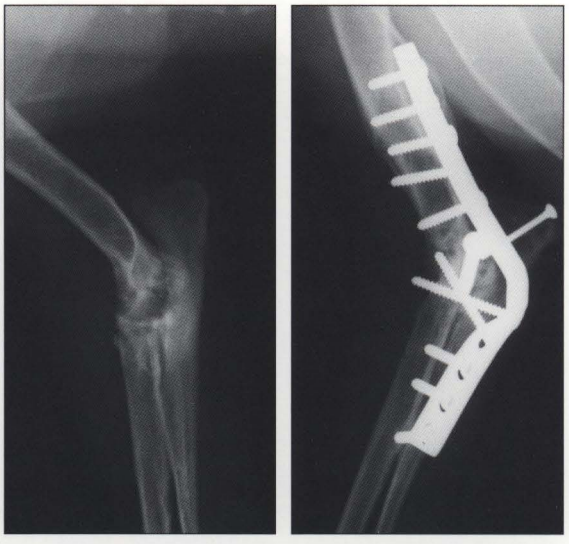
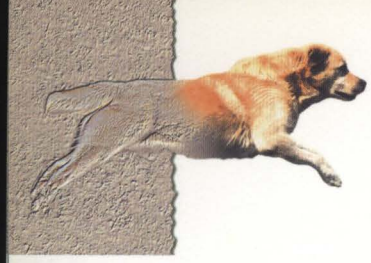


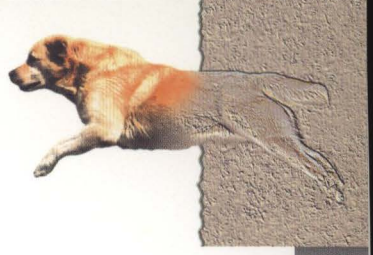
Fig. 16-2 - Arthrodesis for repairing articular disintegration.



This surgical technique, however, is a last resort and is used only when all other therapies are ineffective (Fig. 16). Excisional arthroplasty is easier to perform than joint replacement. However, except in hip joints, the functions of the affected limb are often severely restricted after the surgery.

Although these are not considered routine procedures for small animals, the possibility of cartilage grafting, where the damaged cartilage is replaced with healthy cartilage, and of gene therapy that modifies cartilage metabolism, are also being investigated for restoring joint function.





Conclusion

Easy and objective methods of diagnosing joint diseases of animals are not presently available. Often it is difficult to make a confirmed diagnosis. While treating joint diseases, clinicians have to not only treat the underlying disease but also pay attention to the subsequent restoration of joint functions. Presently, with animals having joint functions that have deteriorated with old age and no specific disease, veterinarians are still groping for methods of understanding the condition of the animals and improving the quality of their lives.

In this publication, the diagnosis of joint diseases and the management of osteoarthritis have been mainly discussed. I would be delighted if the readers find this book useful in understanding a guide to diagnose and treat joint diseases.

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