OTHER IMAGING TECHNIQUES AND THEIR ADDED VALUE TO DIAGNOSE ELBOW DYSPLASIA.

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The diagnosis of elbow dysplasia (ED) in lame dogs is made from a combination of clinical signs, palpation of the joints, and medical imaging. A wide range of imaging options is now available but the “perfect” imaging protocol does not exist because each modality has his strengths and limitations.
Although **radiography** is still the standard technique for diagnosing elbow disorders in the dog, other imaging techniques like scintigraphy, ultrasound, computed tomography (CT) and magnetic resonance imaging (MRI) can be useful.
In diagnosing ED there a two different issues: there is the need for selecting ED free breeding stock and there is the diagnosis of the condition in the individual patient presented for forelimb lameness. For selection purposes, most of the time the secondary degenerative joint (DJD) changes are scrutinised by means of radiographs and mostly the individuals are not suffering lameness. For the individual patient the early diagnosis of the primary lesion is very important because an early treatment guaranties a better prognosis. Although the most important cause of elbow lameness in dogs is medial coronoid disease (MCD), recently flexor enthesopathy (FE) has been recognized as an elbow disorder in medium and large breed dogs and is characterized by lesions of the medial epicondyle and the attaching flexor muscles. The differential diagnosis between both elbow disorders is not obvious and a combination of these two elbow diseases is possible. The challenge in these cases is to define the cause of the elbow pain in order to make the correct treatment decision. In both, MCD and FE, the radiographic features may be minimal and indistinct.
In case where the clinical examination is not providing a clear localisation or in case of uncertain radiographic findings, **scintigraphy** is a useful technique to localise the cause of lameness. Although it is very sensitive, it is not very specific and the spatial resolution offered, is not well enough to specify anatomic structures. Recently a micro-single photon emission tomography (µ-SPECT) technique has been described. **HiSPECT** has a much higher resolution and allows better differentiation of the anatomical areas in the elbow joint. A major drawback to joint imaging by scintigraphy is the normal uptake at the end of long bones, especially in immature animals. In some instances it is difficult to determine whether a difference in counts between two joints represents a meaningful finding. Comparison of bilateral images, acquired over the same time, and quantitative analysis of joint images by computer can provide diagnostic guidelines. In cases of flexor enthesopathy (FE), HiSPECT, reveals focal increased bone tracer uptake in the region of the medial humeral epicondyle.
Ultrasound (US) is a potential valuable imaging technique of the musculoskeletal system in small animals. High frequency linear transducers are used because of their flat application surface and high resolution power. Accurate examination of joints requires substantial ultrasonographic experience and a standardised examination procedure. In most of the joints even small amounts of fluid accumulation (hypo- to anechoic) can be easily demonstrated in the area of the joint pouches. Although a thorough US study of the normal elbow joint has been conducted, US is only of limited use in the diagnosis of a fragmented

coronoid process. Only large displaced fragments can be diagnosed with certainty. Also US is helpful in diagnosing flexor tendon pathology. The main ultrasonographic findings of flexor enthesopathy are pre-insertional hypoechoic swelling, outward bowing and thickening of the common tendon of the flexor muscles. The tendon appears to be heterogenous with decreased echogenicity and focal or diffuse areas of irregular fibrillar appearance and ill-defined margins with partial or complete tears. Additionally cortical irregularities at the medial epicondyle (spur formation) and intratendinous calcifications can be detected. **Computed Tomography (CT)** can help significantly in establishing a definite diagnosis. The positioning of the patient is very important and CT of both elbow joints extended with the head pulled back outside the gantry results is better quality images and less artefacts. The scan parameters kV and mA should be high and thin slices eventually with an overlap are preferred. Images should be obtained in bone algorithm and proper windowing during the evaluation of a study is a necessity. The modality of multiplanar reconstructions in different planes is useful in order to evaluate the complete joint surface. Abnormalities in the area of the medial coronoid process include: fragmentation (displaced or nondisplaced), fissure, abnormal shape, sclerosis, osteophytes, and lucencies. A recent study attempts to objectivise the measurement of sclerosis. In the area of the medial humeral condyle sclerosis, lucency, and/or flattening can be evaluated and a differential diagnosis between kissing lesions and real OCD lesions can be made All these abnormalities can be diagnosed on the transverse and reconstructed images. In several cases CT findings, like fissures at
medial coronoid process and subchondral luscencies at medial humeral condyle, were useful for decision making in the arthroscopic treatment of these lesions. A recent study shows that CT is a very reliable technique to evaluate fragmented coronoid process and its results are comparable with arthroscopy, still considered to be the “gold standard”. Ununited anconeal process with or without humeroulnar incongruity can be appreciated and the incidence of incongruities of the humeroradial, humeroulnar, and/or radioulnar joints can be accurately appreciated. On transverse CT slices, at the level of the trochlear notch of the ulna and the humerus, the fitting of the joint space can be noticed. On the reconstructions in the sagittal and dorsal plane, at the level of the trochlea humeri and the lateral ompartment the incidence of a step between the ulna and radial head, the shape of the trochlear notch and the fitting of the humeral condyle in the trochlear notch can be evaluated. In cases of FE, the medial epicondyle appears sclerotic and shows a clear periosteal reaction in all cases. Mineralized opacities can be present within the flexor tendons. CT also shows concomitant lesions like coronoid disease whenever present. The soft tissue studies presents a thickening of the involved tendons in and IV administration of contrast shows enhancement in the affected tendons. **Arthro-CT** can be used to evaluate loss of cartilage in cases of medial compartment syndrome.

Magnetic Resonance Imaging (MRI) has limitations for imaging the canine elbow based on the relatively small size of the joint and complex articulations in conjunction with the thin articular cartilage surfaces of the humerus, radius, and ulna. These limitations depend also of the field strength of the MR device. All MRI planes, dorsal, sagittal, and axial/transverse, are potentially useful for diagnosis of elbow disorders. The incidence of subchondral bone pathology and oedema can be diagnosed. This technique offers a great visualisation of the soft tissues around the elbow joint and in cases of pathology within the flexor tendons its application can be very useful. On Magnetic Resonance Imaging (MRI), the sagittal T2-weighted sequence reveals a hyperintense signal around the proximal aspect of the flexor muscles extending in the muscle bellies. This signal can be confirmed as being a fluid signal

on the fat suppressed STIR sequence. The T1 and T2 studies showed a thickening and irregular delineation of the involved tendons. There is obvious enhancement on T1 contrast studies.
As well as providing valuable diagnostic information about the elbow, **arthroscopy** also allows minimally-invasive treatment of coronoid disease. It allows us to obtain a magnified panoramic view of the inside of a joint. The drawback of arthroscopy is that it only allows the inspection of the articular surface. The combination of CT and arthroscopy allows a more complete diagnosis of ED. In cases of FE, arthroscopy shows the presence of loose fibres, degenerated tendinous tissue, cartilage loss and/or local synovitis at the attachment of the flexor muscles to the medial humeral epicondyle.

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