

STATE OF THE ART JOINT REPAIR IN VETERINARY MEDICINE

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AUTHOR'S PROFILE

Dr. Matis qualified from the University of Munich in 1970, where she received her Dr. med. vet. degree in 1972 and her Dr. med. vet. habil. (PhD) in 1981. She is currently Professor of Surgery and Head of the Clinic of Surgery (including Ophthalmology and Radiology) at the Ludwig-Maximilians-University of Munich. Prof. Dr. Matis was President of AO Vet International (1996–1998) and President of the European Society of Veterinary Orthopaedics and Traumatology (1998–2000). Since 2005 she is President of the European College of Veterinary Surgeons. In 2001 she received the WSAVA Saki Paatsama International Award. Prof. Dr. Matis has published numerous articles and textbook chapters in the field of companion animal surgery. She is co-editor of two textbooks. Her primary areas of interest include small animal orthopaedics and traumatology, computerised gait analysis and imaging techniques.

INTRODUCTION

Joints allow flexibility and movement of the body. They absorb shock and provide stability during motion and weight bearing. Diarthroses, or synovial joints, provide the greatest movement and are the site of most joint diseases in animals. It is estimated that approximately 20% of all dogs suffer from osteoarthritis. Radiographs of older cats also commonly show degenerative joint lesions. However, in contrast to dogs, such degenerative changes are rarely clinically apparent in feline patients. While in the cat the aetiology of joint disease is mainly traumatic, developmental and degenerative joint diseases are becoming increasingly more important in the dog. In 2003, American dog owners spent as much as 1.32 billion dollars (1.08 billion Euros) in surgical repair of ruptured canine anterior cruciate ligaments.¹ Calls for preventive measures such as strict selection of breeding stock and balanced restrictive nutrition are hence becoming more and more important.

TRAUMATIC JOINT DISEASE

Reconstructive surgery still represents the treatment of first choice for traumatic joint diseases and particularly for articular fractures (figs 1a, 1b and 1c). Early anatomically correct and stable reduction of fragments, and application of careful soft tissue sparing preparation techniques, are mandatory for re-establishing joint congruency and also for rapid mobilisation. Yet, a poor outcome and osteoarthritis may occur even when the principles of joint fracture repair are carefully adhered to. Long-term results of 120 cats and 190 dogs with surgically treated articular fractures of the

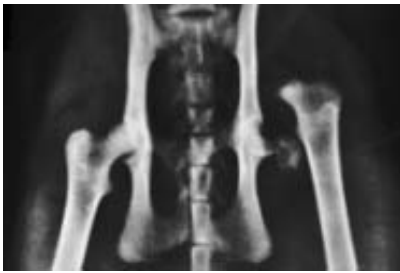


Figure 1a. Physeal fracture separation of the femoral head and greater trochanter in a nine month old cat. Pre-operative radiograph.



Figure 1b. 1 month post-operative.

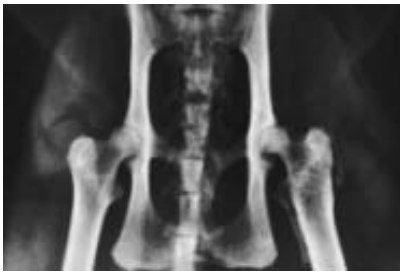


Figure 1c. 9 years post-operative.

shoulder, elbow, and knee, that were re-evaluated clinically and radiologically after 5 years, on average revealed an incidence rate of arthrosis of between 40 to 90%; the incidence of lameness was 20 to 40%.²³ In cats, degenerative changes affected mainly the stifle joint, whereas in dogs the hip joint was most commonly affected. The type of fracture and degree of dislocation had a greater influence on the outcome than the time of

surgical intervention. For all the joints, arthrosis of the elbow had the most detrimental affect on joint function. Also, trauma of the tarsal joint often results in disabling secondary arthrosis.^{4,5,6,7} In this respect, concomitant ligament lesions have a significant influence on the clinical outcome.

LIGAMENT TRAUMA

In general, traumatic lesions of the joint capsule and ligaments carry a poorer prognosis than fractures that have been reduced in an anatomically correct and stable fashion (figs 2a and 2b). This becomes readily apparent when comparing hip fractures to femoral luxations.

While the severity of traumatic lesions and precision of reconstruction are of major importance for the outcome of intra-articular fracture repair, joint configuration is an important prognostic factor for long-term results of luxations. Our studies show that the outcome for femoral luxation is best in cases that do not recur after closed reduction. This is due to a more favourable architecture of the hip joint. Whether conservative reposition and hence lower invasiveness is responsible for the lesser risk of arthrosis development is presently still unclear. In dogs, it has become more common to reduce articular fractures under arthroscopic control. However, controlled studies that compare open reconstruction to arthroscopic repositioning of fractured joints have, to the author's knowledge, as yet not been conducted in veterinary medicine. Retrospective studies on dogs with a fragmented medial coronoid process (FCP) revealed no difference between surgical and arthroscopic joint revisions with regard to the development of post-treatment arthrosis.⁸

Today, lesions of capsular ligaments are mainly treated with the help of suture anchors in order to reconstruct the normal anatomy of soft tissues. However, with regard to surgical repair of a ruptured anterior cruciate ligament (ACL), the results of reconstruction have not been as good as expected. Neither replacement of the ACL by numerous techniques, nor capsulorrhaphy and transposition of the fibular head are able to provide long-term stabilisation of the stifle joint. It was only the tibial plateau leveling osteotomy (TPLO) as a novel therapeutic concept by Slocum⁹ that brought a real



Figure 2a. Coxofemoral luxation in a 12 month old cat. Pre-operative radiograph.



Figure 2b. 4.5 years post-operative.

breakthrough (figs 3a and 3b). Controlled studies show that TPLO is superior to conventional techniques.¹⁰ To satisfy the principles of evidence-based medicine, studies that include and document radiographic follow-up examinations are required to determine whether Tibial Tuberosity Advancement (TTA), a technique that has been advocated only recently,¹¹ yields equally good

results. With TPLO, the incidence of post-surgical arthrosis is lower than with conventional techniques, and there are observations indicating that arthrotomy and meniscal release are not necessary in most cases when TPLO is performed.^{12,13,14} Second look arthroscopies have confirmed that TPLO can prevent a complete rupture in cases of partial rupture of the ACL.¹⁵



Figure 3a. Anterior cruciate ligament rupture in a 3 year old Rottweiler. The pre-operative radiographs show mild arthrosis of the stifle joint.



Figure 3b. Moderate progression of the degenerative joint disease in the femoral intercondyloid fossa and on the tibial intercondyloid eminence 10 months after a tibial plateau leveling osteotomy

HIP DYSPLASIA

Corrective osteotomies for hip dysplasia were quite popular at the beginning of the 1980's. However, they are used much less today because they do not prevent arthrotic lesions. This is particularly true for intertrochanteric



osteotomy. Better results are obtained with a triple pelvic osteotomy (TPO), but only in cases of strict patient selection: the hip joint in question must be free of arthrosis determined by radiographic and arthroscopic examinations. Only a few young dogs with hip dysplasia that are presented by the owner because of lameness fulfil these conditions.⁶

In juvenile dogs, acetabular ventroversion can be achieved by pubic symphysiodesis. However, the symphyseal cartilage must be destroyed early, i.e. at the age of 3 to 4 months at the latest.¹⁷ Satisfactory results have been reported in puppies with a distraction index of less than 12°.⁶ Yet pubic symphysiodesis is not recommended from a breeding or genetic point of view, at least as long as genome analysis is not available to assess the risk of hip dysplasia.

Rapid and reliable pain relief and optimal limb function can be achieved by total hip replacement even in cases in which arthrosis has already developed (figs 4a and 4b). Hip replacement can be performed in adult dogs of all ages provided that neuropathies (degenerative myelopathy, prolapse of intervertebral disks, vertebral tumours) and other causes for lameness of the hind limbs (e.g. ACL rupture) can be ruled out. In addition, inflammatory diseases (e.g. dermatitis, otitis, periodontitis and gingivitis, anal sac inflammation, and prostatitis) must be addressed prior to surgery. In some cases, good long-term results have been achieved even in juvenile dogs.¹⁹ Total hip prostheses anchored by bone cement (polymethylmethacrylate) are widely used, but cementless prostheses are also available and have become increasingly more popular. Cemented prostheses have the advantage of better adaptability to the anatomic variations of dogs. Cementless prostheses are less prone to inflammation, but are equally demanding with regard to surgical technique. For both types, success is determined predominantly by the experience of the surgeon, the bone implant bed, and the available size of the implant. With an experienced surgeon performing the total hip replacement, success rates make up 90 to 98%. In contrast to human patients, early wear of the prosthesis is not a problem in dogs because there is less stress on the prosthesis and the lifespan of dogs is shorter. In both

human beings and dogs, aseptic loosening of the prosthesis is the most common cause for recurrent complaints (see the text 'Human mobility-benefits and limitations of total joint replacement in the hip and knee' in these proceedings pages 46-48). Surgeries that were carried out prior to total hip replacement generally increase the risk of complications. However, even in unfavourable situations that necessitate removal of the prosthesis, functional restoration is still possible, because capsular fibrosis induced by the prosthesis can create a stress-resistant syndesmosis.⁶



Figure 4a. Bilateral coxarthrosis secondary to hip dysplasia in a 1 year old German Shepherd. Pre-operative radiograph.



Figure 4b. Radiograph taken 10 years after total hip replacement of the right coxofemoral joint and 11 years after total hip replacement of the left coxofemoral joint.

Excision arthroplasty of the hip joint does not withstand critical review of its outcome by computerised gait analysis when compared to successful implantation of a prosthesis: the latter is clearly superior.²⁰ However, it is reassuring to have arthroplastic resection as a back-up technique when complications occur after hip replacement. For irreparably damaged hips in cats, excision arthroplasty is still a recommendable treatment option.

ELBOW DISEASE

A cemented elbow prosthesis has recently become available. Demand for a replacement of this joint has increased drastically due to the high incidence of elbow dysplasia in predisposed dog breeds. Elbow arthroses often give rise to significant complaints, however, osteotomy rarely provides an acceptable outcome and arthrodesis of this joint is unsatisfactory with regard to joint function. For this reason interest in elbow prostheses is particularly high. However, total elbow replacement is difficult. If removal of the implant becomes necessary, salvage is only possible by arthrodesis or amputation. To date only a limited number of dogs have been treated successfully by implanting an elbow prosthesis and the duration of post-operative assessments is at the present time too short for a conclusive evaluation.²¹

DISEASES OF THE STIFLE

A stifle prosthesis will also soon become available. Although total stifle replacement is not indicated as frequently as total replacement of the hip or elbow, it should benefit some patients. The procedure for stifle replacement is more demanding with regard to surgical skills and the characteristics of the implant, than that for hip replacement, and the requirements are similar to those of elbow replacement.²² Thus, procedures aimed at joint preservation will remain the first line of treatment in the near future. Arthrodesis is much better compensated in the stifle than in the elbow, but not nearly as well as arthrodesis of the carpal and tarsal joints.

SUMMARY AND FUTURE DEVELOPMENTS

Future studies are required to determine whether it is possible to reduce the enormous use of nonsteroidal anti-inflammatory drugs by techniques for joint

preservation such as osteochondral autogenous transfers, cartilage cultures and autografts, stem cell technology and gene therapy. It is also necessary to determine whether these techniques will increase mobility of arthrotic joints in the long term. From a rational viewpoint, these techniques are not likely to be successful in an environment of destructive processes which occur in elbow and hip dysplasia.

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