VOORJAARDSDAGEN
European Veterinary Conference

2007 - AMSTERDAM

PROGRAMME AND SCIENTIFIC PROCEEDINGS
Introduction
The horse is used for its locomotion capacities; therefore, it is not surprising that disorders of the musculoskeletal system are the most common cause of wastage in horses. Of these disorders, joint-related ailments are the most frequent and clinical interventions, such as arthroscopy, are as common in equine practice as they are in human medicine. Like in man, cartilage injury is a major problem and many horses have to be retired from their athletic careers, or even have to be euthanized, because of unrepairable damage and subsequent osteoarthritis of the articular cartilage.

Non-specific treatments, analgesic or non-steroidal anti-inflammatory drugs, are commonly used for joint disease. Viscosupplementation, intra-articular injections of high molecular weight hyaluronic acid exhibiting viscoelastic properties close to those of synovial fluid, may also be proposed for joint disease. However, such procedures, even though alleviating symptoms, only afford a slowdown of the degenerative process.

Articular cartilage responds differently to injury than other tissues. Unlike other tissues, cartilage has no direct blood supply, lymphatic drainage, or innervation. In addition, articular cartilage has an extremely slow regeneration rate, and chondrocytes can’t migrate within the matrix to the site of injury as do cells in other tissues. In partial-thickness cartilage injury, the response is limited or nonexistent. Probably related to the extremely long turnover of the collagen framework and the lack of a vascular supply preventing a true inflammatory or cellular response. Thus, the defect is not repaired. In articular cartilage defects that penetrate the subchondral bone, a reparative response is generated. Initial granulation tissue is converted into fibrocartilage or a mixture of hyaline cartilage and fibrocartilage. Fibrocartilage is not as effective in maintaining joint function as hyaline cartilage. It has weaker mechanical properties, cannot distribute forces as well, and, over time, is prone to fibrillation and breakdown. Therefore, damage to hyaline cartilage, with or without damage to the underlying subchondral bone, has long-lasting consequences.

Several surgical methods have been developed to encourage the regeneration of cartilage defects of which the primary goal should be filling and restoration of the articular surface with the best possible repair tissue. Long lasting biomechanical properties resembling that of hyaline cartilage and a full integration with the surrounding articular cartilage should result in pain free movement and prevent early joint degeneration. Several arthroscopic and open, experimental and clinical techniques are being developed and used in clinic currently.

Lavage and debridement
The initial arthroscopic treatment (with or without laser surgery) of isolated chondral injuries was to overcome mechanical impediment by removing loose or unstable cartilage and to limit the rate of degeneration. However, most reports on this technique are based on subjective, retrospective studies. There is no scientific evidence of any biological repair activity resulting from arthroscopic lavage in humans. Moreover, a recent randomized, placebo controlled study in humans, evaluating the efficacy of arthroscopy for osteoarthritis of the knee showed that the outcomes after arthroscopic lavage or arthroscopic debridement were no better than those after a placebo procedure.

Subchondral bone penetration
Penetration of the subchondral bone by either abrasion arthroplasty, drilling or the microfracture technique opens the vascular and bone marrow system. Cytokines, fibrin clot formation, growth factors and vascular invasions as well as mesenchymal stem cells are recruited to induce chondrogenesis. Because of its technical
simplicity and low morbidity it is often used as a first line treatment option for articular cartilage defect repair in humans. In horses the microfracture or micropick technique is strongly advocated due to economics and ease of application. However, scientific evidence for horses is still limited but individual experiences are promising.

Osteochondral techniques
These techniques involve transplanting single (large, arthrotomy) or multiple (small, arthroscopy) osteochondral plugs from less loaded areas or using donor tissue. A wide range of reasonable to excellent results have been described in humans and individual experiences seem favourable in horses too. However, technical skills are demanding and autografts can only be harvested from a limited area in horses. Furthermore, insufficient proof exists that this procedure does not induce arthritic deformation, as matrix integrity and joint homeostasis are disturbed. Allograft osteochondral transplants provide the advantage of matching size and geometry of the full defect but storage influences and disease transmission remain to be addressed.

Perichondral/periosteal transplantation
With this technique chondral lesions are treated with debridement and transplantation of costal perichondrium or periostal grafts. Progenitor cells from the cambial layer are, in a synovial joint environment, responsible for defect filling with cells and extracellular matrix. Promising short term clinical results are reported but long term results seem to be disappointing.

Autologous chondrocyte transplantation (ACT)
ACT is a FDA approved technique to treat articular cartilage injury in man and used worldwide. It is a two stage-procedure in which articular cartilage biopsies are harvested arthroscopically, propagated ex vivo in cell culture, and later implanted under an autogenous periosteal tissue patch. Clinical outcome in multiple studies in man have reported good to excellent results and preliminary results in equine studies are promising.

Tissue engineering
Tissue engineering aims at reproduction of tissue with similar structural and biological properties for functional replacement of tissue. Cells (mesenchymal stem cells, ear chondrocytes etc.), biological or artificial matrices (hyaluronic acid, silk, polyactic acid, recombinant collagen etc.) and stimulating factors (transforming growth factor-beta, insulin-like growth factor-1 etc.) are used to form hyaline cartilage for articular cartilage repair.

In conclusion, several techniques are being developed and tested in vitro, in vivo and clinically in humans, horses and other animals. Some of them are even being used in daily practice. However, so far there is no single therapy that provides an overall solution and can claim true functional and durable repair of articular cartilage.

A reference list is available from the author