A Review of Osteoarthritis Model Construction Techniques

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Osteoarthritis (OA) can affect any joint in body. Post-traumatic osteoarthritis (PTOA) often occurs due to knee joint injuries and damage to joint stabilization structures, such as anterior cruciate ligament (ACL) and/or meniscus. The onset of this condition generally depends on the initial joint trauma, joint instability and chronic inflammation, and lack of restoration of normal joint kinematics of the desired joint after surgery. However, the etiology of PTOA has remained unknown. A degenerative joint disease, PTOA causes irreversible damage to the articular cartilage\(^1\). Animal models are required to better understand the OA progression, especially in the early stages. Moreover, the new medications and treatment methods must be assessed to better control the external variables and evaluate the process of the disease. In humans, the description of the lesion is limited to the time of surgery.

Today, medical imaging data provide useful information at the early stages, including determining the location and duration of changes in various joint tissues. Specific changes seen in the radiography of the joint are the detection of joint space narrowing, sclerosis and subchondral cysts, and formation of osteophytes. However, the radiography of the joint does not fully detect cellular and molecular changes in the early stages of the disease. Therefore, animal models are appropriate tools for detection of kinetic changes in tissue and activation or inhibition of the involved molecules, providing a broad insight into the development of new molecules and their effectiveness\(^2\). The chronic nature of the disease, as well as the variability in the interval between the onset of symptoms and the disease have led to the poor understanding of the pathogenesis of this condition. As such, animal models are applied to achieve the pathogenesis of disease and the efficacy of new therapeutic models.

Considering the heterogeneity of the disease stages, which results in various interpretation of results of each model depending on human clinical conditions, application of only one animal model is not sufficient to assess all the characteristics of the disease\(^3\). Animal models are used to study both acute and chronic responses to injury and can be spontaneous or inductive. This disease spontaneously occurs in STR/ort and transgenic mice. Intraarticular injection of the chemical compound of monoiodoacetate induces OA as well. Today, surgical models are extensively applied, all of which cause joint instability\(^3\). The progression and grading of OA are determined by histological methods and the overall status of the condition by analyzing the changes in gene expression and deproteinization of the degenerated cartilage. Various models, including mice, horses, dogs, and rabbits, have been used in this regard, which are further targeted by the intervention in the joint, and changes in the articular joint have been recorded in various periods, including after 1-14 days, and after 2-6 and 6-52 weeks\(^4\).

In 1970, the progressive model of OA was created in a rabbit by removing the lateral collateral ligament, medial meniscus, and both...
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Previously, the sciatic nerve cutting methods and/or intraarticular papain injection were used but none of them determined the primary changes of the disease. In fact, the chemical models mostly cause inflammatory arthritis and lead to less physical degenerations\(^5\). Therefore, physical degeneration of the cartilage with the cause of artificial instability in the ACLT model in rabbits and guinea pigs provides a model more similar to OA in humans. 

References


