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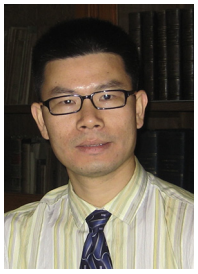
EDITORIAL

Degenerative musculoskeletal diseases: Pathology and treatments



Many musculoskeletal disorders are a result of long-term degeneration, often presenting in the late stages of the disease. As most degenerative disorders, such as osteoarthritis (OA) and degenerative disc disease, appear in the elderly, the global ageing challenge is likely to increase the prevalence of these diseases and, therefore, their burden on society. Translational medicine is a promising approach to determining the exact pathology of degenerative diseases that can aid in establishing better prevention and treatment options, rather than treating the late-stage manifestations of the disease. We are pleased to present this special issue on the topic of degenerative musculoskeletal disorders, investigating both the basic science and clinical advancements to better understand and tackle these diseases.

The aetiology and pathogenesis of scoliosis is poorly understood, and various factors, such as genetics and neuromuscular disorders, have been proposed as causes of this disease, but most cases have unknown causes. Without treatment, scoliosis will continue to progress and may result in severe complications, such as lung and heart damage, chronic back pain, and social rejection. While treatments are available to correct the spinal curvature and minimise the damage, patients may still be affected by the disease throughout their life. Chen et al. [1] propose a novel aetiopathogenesis of scoliosis, suggesting that imbalanced growth between the thoracic vertebral column and the sternum may lead to spinal curvature.

The development of novel biomaterials is a promising strategy for long-term treatment and possible tissue regeneration. Although osteochondral defects are cartilage injuries, they often progress to OA over time; by preventing or treating osteochondral defects appropriately, OA may be delayed or completely avoided. Deng et al. [2] discuss the development of bioactive scaffolds that are created using synthetic and biological materials to mimic the native tissue and provide regenerative properties to treat osteochondral defects. Jiang et al. [3] discuss the development of natural hydrogels, which are a specific type of bioactive scaffold. The review discusses the advantages and disadvantages of hydrogels to treat cartilage damage and degeneration, focussing on the special properties that make hydrogels a promising biomaterial. Biomaterials have been used for decades, but they have evolved into highly advanced materials with the intent to have numerous advantageous properties (e.g. regenerative properties, containing stem cells, biodegradable and so on). Osseous haemorrhage may occur when a bone fractures (fractures are commonly observed in patients with osteoporosis), and this bleeding is difficult to control. Bone wax has been used for decades to create a physical barrier to prevent blood loss, but Zhou et al. [4] describe the advancements that have been made to bone wax and novel strategies to improve its function. Owing to the growing need for orthopaedic implants, a giant industry has evolved, with novel devices and materials being developed constantly to create ideal implants specific to diseases and sometimes individual patients. However, orthopaedic implant–associated infection is a common problem that can have detrimental effects. Wang and Tang [5] discuss surface treatments that may be applied to orthopaedic implants to prevent implant-associated infection. Jia et al. [6] discuss the use of polydopamine as a universal coating to treat various types of implants to improve their surface binding and adhesive properties without compromising the other physical, chemical and biological properties of implants. Osteonecrosis is a severe condition that may lead to arthritis, and it is typically

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treated with surgical intervention and orthopaedic implants. Magnesium is a promising biomaterial that releases osteopromotive magnesium ions as it degrades, to regenerate bone and promote angiogenesis. Chen et al. [7] present a case study in which a pure magnesium screw was used to fix the pedicle bone flap to treat traumatic femoral head necrosis, with a two-year follow-up. Yang et al. [8] have also used magnesium in their study to determine whether magnesium enhances the properties of poly(methyl methacrylate)—based bone cements that are used to treat a wide range of degenerative disorders.

A common theme in the development of orthopaedic biomaterials is regeneration of native tissue. Complete tissue regeneration—either chemical or biological—to restore the damaged tissue to its healthy form is a desirable goal, but difficult to achieve. Stem cells remain a promising option for tissue regeneration, not only in orthopaedics but also in the entire medical field. OA is difficult to treat, in part due to the low metabolic properties of articular cartilage. Xiang et al. [9] provide a comprehensive overview of the use of stem cells and methods of implantation to regenerate articular cartilage. While stem cells remain a promising regenerative treatment, the introduction of induced pluripotent stem cells revolutionised translational medicine. Li et al. [10] review the novel uses and opportunities that these innovative stem cells provide. Rotator cuff tears are commonly due to tendinopathy, an insidious degeneration of the tendon that can lead to tendon rupture. Li et al. [11] discuss the use of hyaluronic acid to treat rotator cuff degeneration using *in vitro* approach and *in vivo* animal models. However, the extraction and processing of stem cells is difficult and often expensive. Cells need to be extracted and sorted to select the exact stem cells to be used for treatment, which is a lengthy and expensive process, not including the remaining steps to create a clinically sound stem cell treatment. Traditionally, fluorescence-activated cell sorting has been used to isolate the target cells, but a new method, reviewed by Chen et al. [12], discusses how cell migration may act as a selection factor, thereby reducing processing time and costs.

Diagnosis often requires laboratory tests to be conducted, and similar to clinical treatments, diagnostic procedures are continually evolving. In order to test certain features and properties of bone, samples first need to be decalcified; this process is lengthy, extending the diagnostic time. Chow et al. [13] propose the use of a novel ultrasound decalcifier (DeCa DX1000; Pro-Cure Medical Technology Co. Ltd, Hong Kong) to shorten the time required to decalcify bone samples. This method is helpful for the diagnosis of bone diseases.

We anticipate that this special issue will provide researchers and clinicians valuable insight into the challenges that degenerative diseases pose, as well as novel strategies to investigate and treat these diseases.

Conflicts of interest

The authors have no conflicts of interest related to this article to declare.

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