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EDITORIAL

Orthopaedic imaging for translational research and clinical application

Medical imaging is one of the most important tools in all medical disciplines; however, few medical specialities benefit more from medical imaging than orthopaedics. There are various types of imaging applications, such as diagnosis and differential diagnosis, therapeutic monitoring, surgical planning, and three-dimensional printed implants. We are proud to present this special issue focussing on novel imaging techniques to analyse and characterise musculoskeletal tissues, development of three-dimensional models and systems, comparison of current imaging technologies, and the use of imaging in both basic science and clinical practice.

With the recent improvements and advancements in imaging technology, we may further develop our characterisation of various tissues and develop better methods to identify and diagnose their associated diseases earlier. A variety of techniques have been developed to improve the diagnostic performance of ultrasound. Onishi et al [1]. describe how ultrasound elastography and ultrasound tissue characterisation improve tendon characterisation and ultimately improve our ability to diagnose tendinopathy. Shen et al [2]. describe methods using magnetic resonance imaging (MRI) to manage patients after oncological prosthetic reconstruction surgery. Exploring alternative imaging technologies may provide improved information on a patient's outcomes better than conventional techniques. The article on computed tomography (CT) by Engelke et al [3]. provides an in-depth discussion on the development and use of this technology to image and define muscle properties and characteristics.

All tissues are three-dimensional, and as such, earlier imaging techniques that generated two-dimensional images could not provide a complete narrative of the tissue being observed in a single image. Wu et al [4]. describe a three-dimensional digital lumbar spine model that is able to assess novel transpedicular transdiscal screw fixation. Development of this technology may aid in reducing the burden on *in vitro* and *in vivo* studies. A similar study by Zhao et al [5]. describes a method of using CT to assess patients' spines and determine ideal surgical options for individual patient before surgery, thus improving our ability to provide personalised medicine, tailored to an individual's needs.

Studies that help to compare standard and new imaging techniques can help radiologists and clinicians determine the best imaging technique for their need. Dai et al [6]. compare novel imaging techniques of diffusion tensor imaging and neurite orientation dispersion with density imaging to determine if these novel techniques are better at determining postoperative outcomes of posterior cervical laminoplasty than conventional MRI. Lai et al [7]. demonstrate that biplanar linear radiography may provide valuable information to better aid clinicians in understanding and treating scoliosis than the conventional X-ray and CT techniques.

Imaging techniques are widely used in clinical practice; furthermore, their use in basic research and animal studies has become increasingly important, particularly as it relates to imaging used in clinical practice. Yang et al [8]. demonstrate the use of conventional MRI and CT in their animal study to develop an animal model of disc degeneration. They demonstrate that these imaging techniques are essential to determine whether their interventions mimic disc degeneration observed in clinical practice.

None of these advancements or studies would be possible without trained radiologists. As evidenced by Wang et al [9,10]. in two published reviews, radiologists are key

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personnel who should be consulted to obtain, interpret and analyse images in conjunction with clinicians for optimal care. Radiologists can provide essential insight as to whether obtaining images is useful or could indeed be harmful [9], and they can provide their expert opinion on difficult diagnoses [10]. Thus, it is not only important to develop our imaging techniques but also to develop the skills and knowledge of trained radiologists.

We anticipate that this special issue will provide valuable insight for researchers, clinicians, radiologists and biomedical engineers in the orthopaedic field to understand the opportunities that novel and even conventional imaging can provide in their research and practice.

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