The role of environmental factors in regulating chondrogenesis of mesenchymal stem cells – Implications for cell based cartilage repair therapies.

Articular cartilage has a limited capacity for repair. Cell based therapies such as Autologous Chondrocyte Implantation (ACI) can be used to treat cartilage defects, but there is no conclusive evidence that conventional ACI is more effective than established techniques such as microfracture. This has lead to increased interest in novel tissue engineering strategies and alternatives to chondrocytes such as mesenchymal stem cells (MSCs) for cell-based cartilage repair therapies. Central to the success of any cell-based therapy is a fundamental understanding of how the local microenvironment influences cell phenotype and subsequent matrix synthesis and organisation. This seminar will first review how our lab is using in vitro models to systematically investigate how MSCs respond to their biophysical and biochemical environment. Key aspects of the in vivo joint environment, such as oxygen tension and dynamic compression, will be considered. The seminar will then outline how the information provided by such experiments can be used to develop models of cell behaviour, which can be combined with tools such as the finite element method to develop predictive tools that can potentially be used to improve outcomes in tissue engineering and regenerative medicine.