Official Journal of TESMA
Regenerative Research
www.regres.tesma.org.my
E-ISSN 2232-0822
Tissue Engineering and Regenerative Medicine Society of Malaysia

Regenerative Research 7(1) 2018 20

TISSUE ENGINEERING RESEARCH IN MANAGING CARTILAGE AND BONE DEFECTS: SCAFFOLDS, GROWTH FACTORS AND CELLS

Tunku Kamarul Zaman Tunku Zainol Abidin*

Tissue Engineering Group (TEG), National Orthopaedic Center of Excellence for Research & Learning, Department of Orthopaedic Surgery, Faculty of Medicine, University of Malaya

ARTICLE INFO

Published: 26th August 2018
*Corresponding author:
Tunku Kamarul Zaman Tunku Zainol Abidin
Email:
tkzrea@um.edu.my

KEYWORDS

Tissue engineering; Regenerative medicine; Orthopaedic

SUMMARY

The practice of regenerative medicine (RM) has the potential to heal or replace tissues and organs damaged by age, disease, or trauma. Over several decades, there have been great progress made in this field of medicine, combining several interdisciplinary subjects into a single approach in treating a diseased condition. It has become apparent that during this time, many regenerative therapies especially those designed for wound healing and orthopedics applications have been introduced. Some of which have even received Food and Drug Administration (FDA) approval and are now commercially available. Nevertheless, despite the progress made in this area, the search for the ultimate regenerative therapy for many orthopaedic conditions continues as many therapies have yet been able to achieve good long-term outcomes. More specifically, the common condition of degenerative disease involving synovial joints i.e. Osteoarthritis (OA), remains elusive to the therapies that have been suggested, prompting more research into this debilitating disease to be undertaken. OA being a complex disease associated with increasing age, requires a profoundly deep understanding of the underlying pathogenesis in order for the disease to be treated. In the absence of such wholistic knowledge, implementing a method to regenerate diseased cartilage becomes paramount especially in light of the relatively short lifespan and limitations offered by current joint arthroplasties technique. Our approach to achieving superior outcomes comes from the implementation of tissue engineering and other biological repair methods. Over more than a decade now, we have reported on the use of different scaffolds, growth factors, different cell types and stem cells, and their combinations to achieve superior cartilage regeneration. We also demonstrated the role of subchondral bone in the development of OA and its importance to be addressed; in order to achieve better cartilage repair outcomes. Of worth mentioning here as examples are of the role of 3D alginate-fucoidan composite hydrogel as a biomaterial that augments the chondrogenic differentiation of mesenchymal stromal cells. Other scaffolds such as PVA-chitosan composite hydrogel versus alginate beads as a potential mesenchymal stem cell carrier for the treatment of focal cartilage defects were also reported. For bone regeneration, we have explored the use of coral graft, PLLA and Fucoidan-TCP Chitosan scaffolds to address the issues of subchondral bone deficiencies. On another front, cell therapies such as invasive transplantation of allogenic mesenchymal stromal cells, platelet rich plasma, supplements such as chondroitin, bone marrow stimulation and many others to enhance the regenerative outcome of damaged cartilage have also been explored; demonstrating superior outcomes. Our efforts have now progressed to involved more extensive RM applications by combining several known promoters of regeneration with newer modalities such as mechanotransduction. In this lecture, we will discuss the observed outcomes of our previous studies and what to expect in the near future by exploring several potential leads that may further enhance the regenerative process of degenerative tissues, i.e. bone and cartilage.