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Editorial

Role of Tissue Engineering in Controlled Drug Delivery

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INTRODUCTION

Tissue engineering has three main applications in the field of medicine one is the maintenance of the cell matrix structure, 3-D material matrix, drug molecular signaling, regeneration of the living cells in the damages tissues and organs. Now it has been proved the advantages of tissue engineering can be applied to the ideas of controlled drug release for better therapeutic activity of the drugs with minimal side effects or adverse effects [1].

The field of tissue engineering is provided with the usage of the simulative Biomimetic materials that facilitate in inducing an appropriate condition and environment for the recruitment, adhesion, proliferation, and differentiation of cells at micron level. This method can further improved by the addition of this biomimetic model with the suitable drugs that have ability to act on the cells or tissue that further involves in tissue regeneration and cell proliferation. The drugs introduced in this model can be chemicals, peptides, proteins, growth factors, cytokines, and other bioactive molecules that are utilized to stimulate cellular activities and new tissue regeneration and also supporting the cells in the tissues [2].

The improved and upgraded tissue engineering systems sometimes integrate one or more of these three fundamental components like biomaterial matrices, living cells, and bioactive drugs. Categorically, there is a flourishing aspire to mimic the induce complexity of natural tissue by delivering multiple drugs synchronously, sequentially, or in multiphasic patterns. Researchers are thinking that having perfect control over the delivery of multiple stimuli over time will improve the speed, quantity, and quality of tissue regeneration thereby repairing the damaged tissues at a faster rate [3].

Scaffolds of tissue engineering were being designed and developed to deliver as the 3D template and matrix microenvironment related to the cell adhesion, proliferation, and differentiation. Consolidating a adjustable drug delivery mechanism into such scaffolds may give a boost to stimulate the growth of new tissue and the repair of injury. Controlled drug delivery can be achieved by physically or chemically adsorbing the drug onto the surface of the material matrix (scaffold), encapsulating the drug directly within the scaffold, or by incorporating drug delivery systems on the scaffold [4].

The subsequent release of the drug occurs by diffusion or due to degradation of the scaffold or encapsulating material. The quantity and duration of drug released can be controlled by altering the composition of the material, the delivery system, or the methods of drug integration. Drug release kinetics and duration can further be tuned by changing the dose of the drug added or by coating the material with a substrate (e.g. heparin) that specifically or non-specifically binds cells or drugs [5].

In tissue engineering, controlled release of drugs from a 3-D matrix like structure can enhance the localized regenerative process and prevent the concerns over the potential unwanted systemic side effects, adverse effects and toxic effects of a drug in the body. Drugs compulsory need to meet a minimum threshold to be therapeutically effective, however due to their short half-lives in vivo conditions of body, it is challenging and confronting to achieve a required dose at the targeted area of injury for an extended period of time without causing unwanted side effects as well as adverse effects, because, over-exposure of cells and tissue to the drugs when they were delivered systemically [6].

CONCLUSION

Controlled release of drugs from tissue engineering scaffolds may help in establishing the localized, clinically linked drug concentrations for extended periods of time. The limitations in the field of controlled release involve in the capability to finely adjust the release of the drug without negatively affecting the mechanical or structural properties of the scaffold and without damaging or quickly eluting and eliminating the drug itself from the body in order to reduce the toxic conditions that may arise from the drug.

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