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Commentary

Short Note on Regenerative Medicine

Louis Weiner*

Wyss Institute for Biologically Inspired Engineering, Harvard University, Cambridge, Massachusetts, USA

DESCRIPTION

The development of medicines that can regenerate tissues and reduce dependency on transplants is motivated by the loss of organs and tissues due to disease and damage. Regenerative medicine is an interdisciplinary field that uses engineering and life science principles to stimulate regeneration in damaged and wounded tissues and organs. Since the field's inception some decades ago, a number of regenerative medicine therapies have been approved by the Food and Drug Administration (FDA) and are now commercially available, including those for wound healing and orthopaedic uses. This will go through these medicines as well as additional regenerative medicine techniques that are currently being researched in preclinical and clinical settings. The latest advances in producing sophisticated grafts and tissue mimics, as well as technology for graft integration with host vasculature, will be addressed. It will be discussed how to improve the host's innate regeneration capability by altering its environment, whether by cell injections or immune regulation, as well as techniques for utilising recently identified cell sources. Finally, we suggest potential directions for regenerative medicine therapy.

Regenerative medicine has the ability to repair or replace tissues and organs that have been destroyed by age, disease, or trauma, as well as to correct congenital flaws. To date, promising preclinical and clinical data support the possibility of using regenerative medicine to treat chronic diseases and acute insults, as well as maladies affecting a wide range of organ systems and contexts, such as dermal wounds, cardiovascular diseases and traumas, cancer treatments, and more. The current approach of transplanting intact organs and tissues to cure organ and tissue failures and loss is hampered by a scarcity of donors and frequent immunological problems, but these issues could be overcome with the use of regenerative medicine technologies.

The utilisation of materials and de novo produced cells, as well as various combinations thereof, to take the place of lost tissue, effectively replacing it both architecturally and functionally, or to aid to tissue recovery, is included in the field of regenerative medicine. Although adult humans have limited regenerative potential compared to lesser vertebrates, the body's intrinsic healing response can be used to boost regeneration. The first part of this study will focus on regenerative medicine therapies that have already been approved by the FDA. The preclinical and early clinical studies to alter the patient's physiological environment by introducing materials, living cells, or growth factors to replace damaged tissue or enhance the body's intrinsic healing and repair systems will be discussed next. It will also be explored how to improve the structural sophistication of implantable grafts and how too efficiently use freshly developed cell sources. Finally, future research directions in the field will be suggested. We have grouped these activities under the topic of regenerative medicine in this study due to the significant overlap in how researchers use the phrases regenerative medicine and tissue engineering.

A number of therapies have gotten FDA clearance or approval and are commercially available since tissue engineering and regenerative medicine began as a business roughly two decades ago. To date, one of the most important paradigms of regenerative medicine has been the introduction of therapeutic cells that directly contribute to the development and function of new tissues. These therapies involve either autologous or allogeneic cells that are typically differentiated but still have proliferative ability. Carticel, for example, is the first FDA-approved biologic product in the orthopaedic profession, and it treats focal articular cartilage abnormalities with autologous chondrocytes. Autologous chondrocytes from articular cartilage are collected, grown ex vivo, and implanted at the site of injury, resulting in healing comparable to that seen with microfracture and mosaicplasty procedures. Other examples include laViv, which uses autologous fibroblasts to improve the appearance of nasolabial fold wrinkles; Celution, a medical device that extracts cells from adipose tissue derived from liposuction; Epicel, autologous keratinocytes for severe burn wounds; and cord blood harvesting for hematopoietic progenitor and stem cells. Autologous cells entail the harvesting of a patient's tissue, which often necessitates the creation of a new wound site, and their use frequently necessitates a delay in treatment while the cells are cultured. Allogeneic cell sources with low antigenicity (for example, human foreskin fibroblasts utilised in the manufacturing of wound-healing grafts (GINTUIT, Apligraf)) enable bulk production of off-the-shelf tissues while reducing the possibility of an immune reaction. Tissue's native Extra Cellular

Correspondence to: Louis Weiner, Wyss Institute for Biologically Inspired Engineering, Harvard University, Cambridge, Massachusetts, USA, E-mail: Louisweiner@georgetown.edu

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Matrix (ECM) regulates cell behaviour, contributes to the formation and function of new tissue, and contains locally available growth factors. 3D polymer scaffolds, for example, are utilised to encourage chondrocyte expansion in cartilage repair [e.g., Matrix-induced Autologous Chondrocyte Implantation (MACI)] and serve as a scaffold for fibroblasts in the treatment of venous ulcers.