Commentary

Recent Advances in Intestinal Tissue Engineering

Martin Chinder[*]

Department of Surgery, Johns Hopkins University and Johns Hopkins Children's Center, Baltimore, Maryland, USA

DESCRIPTION

Medical technology is the bioengineering of functional tissues utilizing the power of developmental and stem cell biology. Tissue engineering and regenerative medicine create new organs from scratch while preserving all facets of healthy tissue structure, physiology, and function. In many organ systems, tissue engineering has advanced significantly recently. Functional tissues were successfully produced for the bladder and liver by planting a combination of progenitor/stem cells on a cellular scaffold, which were taken from a living body for a treatment, and then returned to the living body. The advantage of using natural scaffolds to create these organs is their immuno-compatibility and ability to give the planted cells crucial spatial cues. Even more intricate tissues, like the heart, have been bioengineered using comparable techniques. In terms of clinical care, autologous bioengineered intestinal transplantation is the best option for individuals with severe SBS. Due to earlier resection of malignant tissue, SBS is a highly morbid syndrome that affects both adults and children. It is defined by the inability to properly absorb nutrients because of a loss of intestinal surface area. SBS is frequently brought on in adults by the removal of a sizable part of the intestine as a result of Crohn's disease, ischemia, trauma, or malignancies. Developmental abnormalities such intestinal atresia, volvulus, and necrotizing enter colitis, which is more prevalent in premature deliveries, are associated with SBS instances in children. SBS was thought to affect 3-4 cases per million people in 1997, but it now seems that incidence is increasing.

The intestine is an organ that serves as a barrier against external threats and a means of nutrient absorption. The muscularis, a layer of smooth muscle cells that preserves tissue integrity and performs peristalsis, the mesenchymal stromal cell layer, and the functional layer of columnar epithelium all contribute to the intestinal tube's ability to carry out these tasks. Because the mucosal layer is exposed to the outside world, the epithelial layer is regularly renewed every 7–10 days to guard against the buildup of DNA mutations. Additionally, the intestinal design includes finger-like villus protrusions to improve absorptive surface area. A population of stem cells in a niche at the base of these crypts is

what is driving thetremendous epithelial proliferation within the invaginations of these crypts. What cellular and biologic elements are necessary to produce a healthy intestine? The Vacanti group at Massachusetts General Hospital conducted groundbreaking research in the 1990s that served as the foundation for current approaches to bioengineer the intestine. This team used porous synthetic scaffolds made of the biodegradable Extra Cellular Matrix (ECM) component polyglycolic acid that were seeded with "organoid units," or collections of dissociated rat gut cells. All of the epithelial and mesenchymal cell types typically found in the gut were present in the organoid units, which were also likely to possess the necessary stem cell populations to regenerate both the epithelial and mesenchymal compartments. In order to repair the biological components of the gut and to become vascularized, the seeded scaffolds were then transplanted within vascular areas of host animals. In this location, they developed tiny encapsulated cysts arranged in villus and crypt-like regions.

Importantly, these bioengineered intestinal cysts integrated by producing a pouch-like shape and led to increased weight growth in the animals when they were anastomosed to the intestine of rats who had had major bowel resection—a model of SBS. Although this encouraging outcome encourages the use of modified intestine for transplantation, it merely marks the start of this intriguing procedure. A crucial thing is that this method has also demonstrated possible usage in altered versions of the rat, mouse, pig, and dog (i.e., their large intestine, stomach, and esophagus).

Regardless of these promising outcomes, huge obstacles blocking movement into the clinical domain remain. Tissues were kept with in the designed digestive tract to demonstrate valuable transplantation. Mature digestive tract, neglected to hold the cylindrical design of local digestive tract that will be expected for broad entrails substitution. Because of this proviso, enhancement of framework biomaterials has been a significant exploration center, including the utilization of regular tissue platforms. To set up an acellular platform, gastrointestinal submucosa is de-cellularized bringing about the remainder ECM. This normal platform material holds grave invaginations and villus projections, giving significant spatial data to homing of cultivated

Correspondence to: Martin Chinder, Department of Surgery, Johns Hopkins University and Johns Hopkins Children's Center, Baltimore, Maryland, USA, E-mail: Martinchin90@gmail.com

cells. Further investigations have tried to work on the effectiveness of organoid unit cultivating on platforms by testing different engineered framework materials, pore sizes, mechanical properties, and consideration of fastened development factors.