In Vitro Transformation of the Retina in 3d Model

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ABSTRACT

Many models have been developed to illuminate the human eye and its pathology, formation, and morphology, as well as its function. Micro physiological in vitro models or the creation of microchip internal organs of the eye serve as a new technology to solve a number of problems of the visual capacity. In particular, the inability to obtain and use in vitro 3D bio printing , the collection of 3D biological structures, and the ability of these structures to direct tissue construction play an important role in ophthalmology and tissue engineering.

Keywords: Microchip internal organs, in vitro models, 3D bio printing

Introduction

The retina is one of the most studied human organs today and its morphology and function are the most studied. At the same time, the similarities between animal and human eye cells allow them to be interchanged. In vitro micro physiological methods have been shown to be effective in organ transplantation. The human eye is also one of the organs that allows microchips to be implanted in a microfluidic medium (1). While the creation of a chip-coated cornea has also shown high pharmaceutical results, in-vitro eye cell sampling has become the focus of current research. At a time when these models were evolving, differences between the natural cornea of the human eye and the unnatural cornea were identified and proved to be almost indistinguishable.

Functional capabilities of artificial and synthetic retina

Observing a sunset or a football game and the sequence of complex events are events that take place in front of the eye, where light passes through the front of the eye, where it breaks, and then at the back of the eye. focuses on a thin, mesh curtain. The retina contains many special cells, including photoreceptor cells, that convert light into an electrical signal (2). These signals are then processed and sent to the brain. If photoreceptor cells fail or die, vision loss and blindness may occur (10).

The reliability of electrophysiological recordings of artificial retina depends on the quality of tissue preparation, experimental conditions (stable temperature, continuous perfusion) and the relationship between the retina and the recording array. Too much pressure can damage tissues and cause abnormal activity of neurons. In addition, the

means of applying optimal pressure should not interfere with tissue perfusion or the optical pathway required for light stimulation. This problem was solved by using a transparent dialysis membrane attached to an internally printed 3D step holder, which provides good control of the applied pressure force (3). In addition, record quality control was provided by monitoring the suitability of the retina across the entire chip area, in particular by measuring the frequency and amplitude of initiation events and monitoring tissue adhesion.

The growth of stem cells in retinal tissue organelles closely reflects the developmental stages observed in vivo retina. When cells become a full retina, cells that first detect blue, then cells that detect red and green develop. This condition was detected using thyroid hormone signaling. It should be noted that when done using a specially designed 3D printer, the level of this hormone is not controlled by the thyroid gland (which is not present in vitro), but is controlled by the eye itself (5). It only takes four printing steps and takes about an hour. Semiconductor polymer materials are used to print photodiodes that convert light into electricity.

The role of 3D cell samples

The synthetic retina has great potential as a physiologically suitable model system for the development and testing of new pharmaceuticals, as well as for the study of disease mechanisms. In vitro eye cell sample models are widely used in various fields of research, such as: toxicological screening, permeability, drug uptake and transport, study of cell physiology and tissue engineering and many others cases can be exemplified (6) (8). In addition, 3D cell samples provide a more accurate representation of cell polarization and have a much higher stability and longevity. However, 3D aggregates can be grown for a long time, at least 4 weeks.

Bio ink is the basic unit of 3D construction.

Physicochemical parameters, including printing properties and gelatin kinetics, should be considered as important factors in printing [7]. Based on this, transplantation is performed and corneal transplantation is used to treat severe cases of corneal function loss. Engineers working on eye tissue have agreed to produce synthetic corneal prostheses as an alternative measure. Alternatively, a new technology has been developed that can be used to produce biological tissue for clinical applications based on 3D bioprinting. Researchers are doing this in the field of corneal tissue engineering, to produce corneal structures similar to the structure of the human eye cornea stroma, to produce an existing 3D digital human eye cornea model and a corresponding supporting structure used [7]. It was a 3D bio printing from collagen-based inner ink containing keratocytes of the body. Keratocytes show high cell viability on the first day after printing (> 90%) and on day 7 (83%). Install 3D bioprinting printing as a possible way to design artificial cornea structures. While this can be used to study the reverse cycle of fibrosis in the cornea, 3D bioprinting has generated great interest for this tissue engineering with its ability to direct hierarchical assembly of 3D biological structures to tissue construction (8).

The main task of the galaxy involves precisely printing the cells at high density to achieve the number of cells that make up the retina of the eye. This was crucial in the printing of rod and conical photoreceptor cells to form a light-sensitive layer of the retina. To achieve a coherent localization of the line-cone receptor mosaic, a biomimicry, or self-assembly method, will be required in addition to accurate printing at the single cell level (9) (11). Similar approaches are required to print other types of retina cells to ensure proper attachment to the retina to ensure physiological function and transmission of visual information and to establish horizontal and vertical connections between cells in different layers. In addition, retinal ganglion cells with a gateway that transmit visual information from the retina to the brain must retain their regenerative properties to successfully prolong brain processes through the optic nerve. In this regard, it has been shown that the printed retina can successfully enlarge neuritis in a sample of ganglion cells. Biomimicry here

serves to find a solution to organ transplantation by building organs and tissues that provide the same environment as the human body.

Conclusion

In conclusion, it can be said that the creation of 3D-sized organs, which is one of the most advanced technologies today, helps to create the same eye cells as natural tissues or organs. A number of factors associated with this approach, such as the microenvironment, the gradient of soluble or insoluble factors, the location of cell types, the composition of the medium, and the nature of the forces in the microenvironment, should be considered.

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