Tissue Engineering

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Key Points
➢ What is tissue engineering ➢ Types of tissue engineering ➢ Technology used in tissue engineering ➢ Biomaterials for tissue engineering ➢ Disadvantages of tissue engineering

With the drastic increase in worldwide diseases, it is of utmost importance to discover new and advanced methods to enhance the well-being of the growing and ailing populace. Many new methods have been brought into play, one of the most prominent being tissue engineering. Cell biologists, engineers, and surgeons have come together to work as one, the result being that manufacturing synthetic epithelial, neuronal, and connective tissues is finally possible. Countless requirements for organ and tissue donations drive this industry.[1] Thus, it would not be wrong to say that the rise of tissue engineering's industrial significance is imminent. However, along with the benefits, other factors such as technology, materials required and cons must also be discussed.

Technology and Research:

Tissue engineering has exceeded expectations due to 3D bioprinting. With advancing developments in creating microstructures that can function similarly to human tissues, we are closer to achieving perfection in making synthetic tissues. So how is it done? Well, basically bioprinting is a further utilization of fast prototyping or a combining manufacturing technique to print bio-functional materials in a layer-by-layer method on substrates when immersed in suitable biomaterials. The method is simply printing and patterning cells, or other biological entities, straight onto a substrate or tissue culture dish through an automatic dispensing system. This makes sure that the singular cells and multiple cell types are kept with each other when kept in biocompatible materials to result in convenient 3D working designs. Biomaterials containing cells and other required materials are known as 'bioinks'. Cell-based bioinks are then manufactured into wanted shapes and sizes with geometrical accuracy to build versatile 3D imitative tissue builds. This functions as a propitious portal for tissue printing to form modern and functional 3D tissues from a supply of cells.[2]

Materials:

The three most important things to consider when choosing the biomaterials are biocompatibility, homogeneity in degradation, and printability. Basically, biomaterials are natural or synthetic materials being utilized to repair or replace a tissue. Classifying based on their chemical nature, they are four groups: metals, polymers, ceramics, and composites. Metals possess high mechanical durability along with composites or ceramics; however, the corrosive resistance of ceramics and composites are higher in comparison to other groups. Noticeably, polymers are the most biocompatible and biodegradable out of all. In particular, thermoplastic polymers are the most suitable. These are further categorized into two classes: synthetic polymers and natural polymers. Out of the two, synthetic polymers amount to better properties in relation to their structures and mechanics; when it comes to the formation process, there are fewer drawbacks. On the other hand, natural polymers possess low solubility and high viscosity due to their high molecular weight. Synthetic polymers act

as highly suitable materials in 3D bioprinting due to their unique characteristics such as high stability, prominent microstructure, and governable degradability.[3]

Disadvantages:

Constant processing and advancements of tissue engineering strategies are observed, but there's still persistence of some difficult practical issues, these include the insufficiency of tissue biopsy material and the adversity in cell expansion while keeping the phenotype. Another factor is a lot of focus on simple research dealing with cells and small animals rather than on clinically directed approaches with large animals. Large engineered tissues cannot be massed until experiments are orchestrated with larger animals. Furthermore, another challenge is the testing of mechanical properties of the synthesized tissue before its clinical examination. [4]

Conclusion:

Overall, the pros of tissue engineering definitely outweigh the cons. The field of tissue engineering looks very promising when it comes to meeting diverse challenges with newer inventive developments and will soon bring many solutions for human application. We have witnessed many instances of clinically successful implantations of artificial tissue with host cell growth, and very soon, its uses will definitely be widespread to aid in the service of mankind.

References:

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