Journal of Biotechnology & Biomaterials

Mini Review Open Access

Biomaterial in Repairmen of Intervertebral Discs

Gerick Gold*

Department of Biotechnology, Sorbonne University, France

Abstract

Intervertebral Disc (IVD) degeneration and associated spinal disorders pose significant challenges in modern healthcare, leading to debilitating pain and decreased quality of life for millions worldwide. Traditional treatment options often focus on symptom management rather than addressing the underlying cause, highlighting the need for innovative regenerative therapies. Biomaterials have emerged as promising candidates for IVD repair and regeneration, offering versatile platforms for delivering therapeutic agents, promoting tissue healing, and restoring biomechanical function.

Keywords: Intervertebral disc; regenerative therapies; Biomaterials; Tissue healing; Biomechanical function

Introduction

Intervertebral disc (IVD) degeneration is a prevalent condition that affects millions of individuals worldwide, often leading to chronic back pain, disability, and decreased quality of life. Current treatment options, such as medication, physical therapy, and surgery, primarily focus on symptom management and fail to address the underlying degenerative processes. As a result, there is a pressing need for innovative regenerative therapies capable of restoring the structure and function of the intervertebral disc [1]. Biomaterials have emerged as promising candidates for IVD repair and regeneration due to their ability to mimic the native Extracellular Matrix (ECM) of the disc, provide mechanical support, and promote tissue healing. The complex structure of the intervertebral disc, composed of a gel-like nucleus pulposus surrounded by a fibrous annulus fibrosus, necessitates biomaterials with tailored properties to effectively replicate its biomechanical and biological characteristics. This introduction aims to provide an overview of the current landscape of biomaterials for IVD repair and regeneration. It will discuss the unique challenges associated with IVD degeneration, the limitations of existing treatment modalities, and the potential of biomaterial-based approaches to address these challenges [2, 3].

Description

Biomaterials play a pivotal role in the quest to address Intervertebral Disc (IVD) degeneration, a prevalent condition associated with chronic back pain and functional impairment. Unlike traditional treatments that often focus on symptomatic relief, biomaterials offer a unique approach by targeting the root cause of degeneration and facilitating tissue repair and regeneration [4]. The intervertebral disc is a complex structure consisting of a gel-like nucleus pulposus surrounded by a fibrous annulus fibrosus. Degeneration of the disc involves alterations in its biochemical composition, loss of hydration, and structural breakdown, leading to decreased mechanical stability and compromised biomechanical function. Biomaterials designed for IVD repair and regeneration aim to restore the native structure and function of the disc while promoting tissue healing and regeneration [5, 6]. One of the key challenges in developing biomaterials for IVD repair lies in replicating the biomechanical properties of the native tissue. Biomaterial scaffolds must possess appropriate mechanical strength and viscoelasticity to withstand physiological loads and support tissue integration. Additionally, biomaterials should be biocompatible and biodegradable to minimize adverse reactions and facilitate the natural healing process [7].

Various types of biomaterials have been investigated for their potential in IVD repair, including natural polymers such as collagen, hyaluronic acid, and alginate, as well as synthetic polymers like poly(lactic-co-glycolic acid) (PLGA) and Polyethylene Glycol (PEG). These biomaterials can be fabricated into scaffolds with tailored properties, such as porosity, pore size, and degradation kinetics, to optimize their performance in promoting cell infiltration, matrix deposition, and tissue regeneration [8, 9].

In addition to serving as structural scaffolds, biomaterials can also function as carriers for delivering bioactive molecules, including growth factors, cytokines, and small molecules, to the degenerated disc. Controlled release systems, such as hydrogels, microspheres, and nanoparticles, enable sustained and localized delivery of therapeutic agents, enhancing their efficacy in promoting cell proliferation and matrix synthesis within the disc microenvironment [10].

Conclusion

Despite the progress made, several challenges remain to be addressed, including optimizing biomaterial properties, enhancing cellular integration, and ensuring long-term functional outcomes. Additionally, regulatory considerations and clinical implementation strategies need to be carefully evaluated to facilitate the translation of biomaterial-based therapies into clinical practice. In conclusion, biomaterials hold tremendous potential for revolutionizing the treatment of intervertebral disc degeneration and spinal disorders. With continued research and interdisciplinary collaboration, biomaterial-based approaches offer hope for improving patient outcomes and quality of life, ultimately transforming the landscape of spinal regeneration.

References

1. Warnock JN, Al-Rubeai M (2006) Bioreactor systems for the production of biopharmaceuticals from animal cells. Biotechnol Appl Biochem 45:1-12.

***Corresponding author:** Gerick Gold, department of Biotechnology, Sorbonne University, France, Email id: gerickgold@sorbonne.ac.fr

Received: 01-Mar-2024, Manuscript No. jbtbm-24-130857; **Editor assigned:** 04-Mar-2024, PreQC No. jbtbm-24-130857(PQ); **Reviewed:** 18-Mar-2024, QC No. jbtbm-24-130857; **Revised:** 21-Mar-2024, Manuscript No: jbtbm-24-130857(R); **Published:** 31-Mar-2024, DOI: 10.4172/2155-952X.1000380

Citation: Gerick G (2024) Biomaterial in Repairmen of Intervertebral Discs. J Biotechnol Biomater, 14: 380.

2. Harding MW, Marques LLR, Howard RJ (2009) Can filamentous fungi form biofilms? Trends Microbiol. 17: 475-480.
3. Fukuda H (1995) Immobilized microorganism bioreactors. In Asenjo JA, Merchuk JC. Bioreactor system design. Marcel Dekker Inc, New York. 339-375.
4. Gross R, Schmid A, Buehler K (2012) Catalytic biofilms: a powerful concept for future bioprocesses. In: Lear G, Lewis GD (eds) Microbial biofilms. 193-222.
5. Kobayashi M, Shimizu S (2000) Nitrile hydrolases. Curr Opin Chem Biol. 4: 95-102.
6. Murphy CD (2012) The microbial cell factory. Org Biomol Chem. 10:1949-1957.
7. Crueger W, Crueger A, Brock TD (1990) Biotechnology. A textbook of industrial microbiology, 2nd edn. Sinauer Associates, Sunderland.
8. Kersters K, Lisdiyanti P, Komagata K (2006) The family Acetobacteracea: the genera Acetobacter, Acidomonas, Asaia, Gluconacetobacter, Gluconobacter, and Kozakia. In: Dworkin M (ed) Prokaryotes, vol 5. Springer Science? Business Media, New York.163-200.
9. Li XZ, Hauer B, Rosche B (2007) Single-species microbial biofilm screening for industrial applications. Appl Microbiol Biotechnol. 76:1255-1262.
10. Cronenberg CCH, Ottengraf SPP, Vandenheuvel JC (1994) Influence of age and structure of penicillium chrysogenum pellets on the internal concentration profiles. Bioprocess Eng. 10: 209-216.