

Intervertebral Disk Generation and Associated Chronic Back Pain: Regenerative Therapy is the Key for Intervertebral Disk Degeneration

Chen-Wei Su*

Ocular Surface Center, Miami, USA

Editorial

Received date: 25/10/2016

Accepted date: 26/10/2016

Published date: 02/11/2016

*For Correspondence

Chen-Wei Su, Research Associate, Tissue Tech, Inc./Ocular Surface Center, Miami, USA.

E-mail: csu@tissuetechinc.com

INTRODUCTION

It is estimated that approximately 60% of adult population will experience back pain at some time in their lives^[1]. Around 5.7 million patients in the United States alone suffer from chronic back pain caused by degenerative intervertebral disc (IVD) disease, of which 4.0 million patients have moderate to severe disease. IVD is composed of three components; they are cartilaginous endplates (CEP), nucleus pulposus (NP) and annulus fibrosis (AF)^[2]. To date, CT scan and MRI are often used for IVD degeneration diagnosis and analysis; however, detailed pathophysiological causes of IVD degeneration remains unclear.

Conventional therapies such as physical therapy or surgical intervention including artificial IVD replacement or spine fusion mainly focus on treating the symptoms of the diseases, but not change the diseases indeed. In addition, spine biomechanics may be affected by the surgical procedures, resulting in mobility limitation, increase of intra disc pressure in adjacent segment which can trigger further degeneration and cause irreversible damage leading to the loss of IVD biological function^[3]. Thus, alternative treatments are being proposed and developed. With the reports from numerous publications, degenerated NP cells have been shown to express pro-inflammatory/ catabolic cytokines increase such as IL-1, IL-6, IL-12, IL-17, TNF- α and INF- γ ^[4]. Application of bimolecular therapy (e.g. injection of growth factors or hydrogel), one of the proposed alternative therapies is intended to inhibit the over-expressed/abnormal cytokine production caused by IVD degeneration or stimulate matrix synthesis^[5]. However, challenges such as finding suitable growth factors, and sustained delivery of these growth factors still need to be overcome. On the other hand, cell-based therapy for IVD degeneration has got attention in recent years^[6]. Basically, cell-based therapy means to fill the IVD with implanted cells so as to synthesize necessary materials or positively influence native cells to increase regeneration. Previously, autologous NP cell has been studied and used for implantation; nevertheless, it is not easy to grow and collect sufficient NP cells in vitro due to the fact that it is hypo cellular. In addition, autologous NP cells obtained from degenerated IVD may still carry cell function deficit which makes them unsuitable for implantation. Hence, with the demonstrations from a great number of previous publications in various animal models or clinical experiments, Mesenchymal Stem Cells (MSCs) have been proposed as an ideal cell as it is capable of differentiating to NP cell like phenotypes, enhancing SOX-9 protein or extracellular matrix and promoting regeneration^[7,8].

As the evolution of therapies for IVD degeneration has been investigated for years, it is understood that reducing safety concerns^[9] (e.g. abnormal tissue formation after MSCs implantation) and promoting regenerative efficacy are the linchpins for treating IVD degeneration. Once IVD regeneration is promoted, the associated chronic back pain can be largely reduced and IVD function should also be restored. Thus, in conclusion, developing an effective way in promoting survival and expansion of NP cells and AF cells, controlling the pro/anti-inflammatory and osteogenesis gene expressions, promoting IVD regeneration and enhancing safety during and after the treating procedures should be focused to develop next generation solution for treating IVD degeneration and its associated chronic back pain.

REFERENCES

1. Macfarlane GJ, et al. Predictors of early improvement in low back pain amongst consultants to general practice: The influence of pre-morbid and episode-related factors. *Pain*. 1999;80:113-119.
2. Huang YC, et al. The effects of microenvironment in mesenchymal stem cell-based regeneration of intervertebral disc. *The Spine Journal: Official Journal of the North American Spine Society*. 2013;13:352-362.

Research and Reviews: Orthopedics

3. Eck JC, et al. Adjacent-segment degeneration after lumbar fusion: A review of clinical, biomechanical and radiologic studies. *American journal of orthopedics*. 1999;28:336-340.
4. Molinos M, et al. Inflammation in intervertebral disc degeneration and regeneration. *J R Soc Interface*. 2015;12:20141191.
5. Pereira CL, et al. The effect of hyaluronan-based delivery of stromal cell-derived factor-1 on the recruitment of MSCs in degenerating intervertebral discs. *Biomaterials*. 2014;35:8144–8153.
6. Le Maitre CL, et al. An *in vitro* study investigating the survival and phenotype of mesenchymal stem cells following injection into nucleus pulposus tissue. *Arthritis Research & Therapy*. 2009;11:R20.
7. Richardson SM, et al. Intervertebral disc cell-mediated mesenchymal stem cell differentiation. *Stem cells*. 2006;24:707–716.
8. Pettine KA, et al. Percutaneous injection of autologous bone marrow concentrate cells significantly reduces lumbar discogenic pain through 12 months. *Stem cells*. 2015;33:146–156.
9. Vadala G. Mesenchymal stem cells injection in degenerated intervertebral disc: Cell leakage may induce osteophyte formation. *Journal of tissue engineering and regenerative medicine*. 2011;6:348–355.