Mesenchymal Stem Cell Injections for Treatment of Intervertebral Disc Degeneration

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Abstract

The degeneration of intervertebral discs (IVD) causes a great deal of morbidity, loss of work, and medical expense each year. Ongoing research is directed toward treatment modalities which slow the catabolic process in the degenerating disc with a focus on gene therapy and molecular therapy. While these avenues do have promise, they are plagued with problems including difficulty with persistence of growth factor production and the immunogenic and oncogenic properties of viral vectors.

Mesenchymal stem cells (MSCs) on the other hand have a high capacity for adaptation and persistent survival in many tissues and are associated with none of the problems of viral-mediated gene therapy. In addition, MSCs have been shown to have the capacity to aid in repair and in vitro engineering of many mesenchymal tissues.

We have shown in pilot studies that MSCs can survive for at least 24 weeks in the intervertebral disc. Given the plasticity and longevity exhibited by MSCs, we believe that these MSCs differentiate into resident nucleus pulposus (NP) cells when in this environment. This would be a very significant finding as the process of degeneration is marked by a loss of cellularity in the NP, including the disappearance of notocordal cells.

In addition we have shown that MSCs co-cultured with nucleus pulposus cells induce greater proteoglycan production in the NP cells. This finding is particularly exciting because the MSC have the potential to up-regulate the anabolic pathways of the entire disc.

Based on these findings we are currently investigating the ability of bone marrow-derived mesenchymal stem cells to regenerate the degenerated IVD and evaluating the precise mechanisms of the potential regenerative process.