Injectable Cell Therapy for Degenerative Disc Disease

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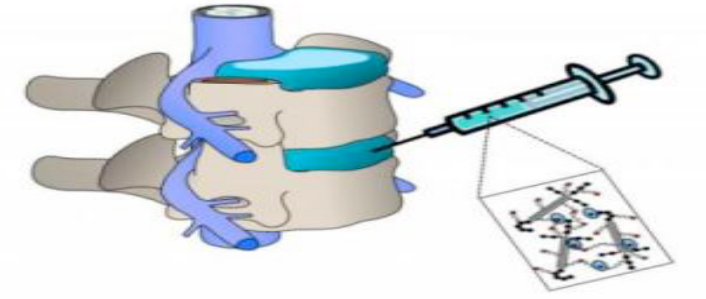
***Abstract*—Degenerative Disc Disease describes the normal changes in a person's spinal chord over the course of their life; specifically the break-down of the nucleus pulposus, which is the spinal chord's jelly-like shock absorber. Recent research at Duke University show that injections of newly created synthetic gels and cells may promote the regeneration of the NP and relieving the back pain that comes along with the disease.**

I. Introduction

Degenterative Disc Disease is technically not a disease, but the natural aging of the spinal chord's Intervertebral Discs (IVD), which can cause severe back pain in older patients, specifically in the cervical and lumbar regions of the spine. This can lead to Osteoarthritis (the breakdown of protective cartilage), herniated discs, and spinal stenosis (the narrowing of the spinal canal). Previous treatments of this condition have involved injecting NP cells or even stem cells back into the spinal chord, but have been shown to be ineffective due to the poor delivery vessels of the cells, which don't hold the cells in place at the injection site for more than 3-4 days. Recently, researchers from Duke University have developed a new gel, made up of the chemically modified protein laminin-111 and two polyethylene glycol hydrogels. These substances combined have shown to create a gel that effectively holds cells in place relatively long after injection. This gel also mimics laminin, which is a protein native to NP. This ensures the persistence and biosynthesis of the injected NP cells.

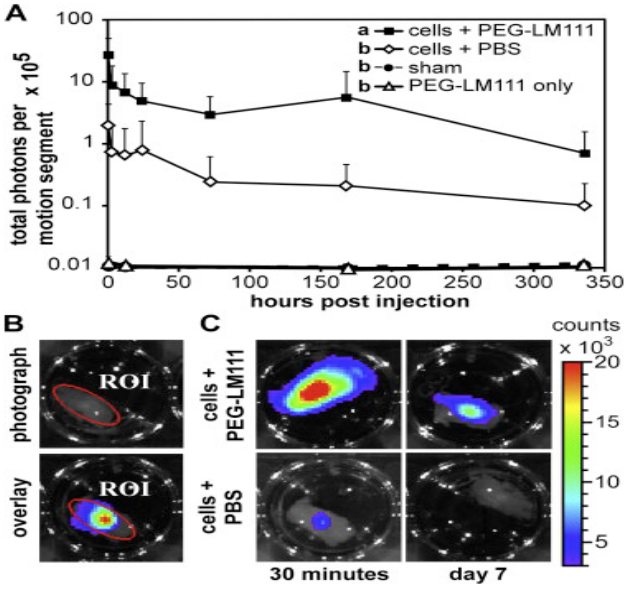
II. Methods

Concerning tests on mice, the three substances used as the vesicle gel for the implanted cells are delivered together in a syringe directly into the affected IVD. The substance along with the cells exits the needle as a liquid, and takes about a minute to be fully injected into the spine. The injection spot is then subsequently closed. After only 5 minutes the substance begins to solidify in the NP, and after 20 minutes is completely set.



III. Results

Researchers use a luciferase biomarker to track any migration of injected cells out and away from the injection site within the following days after the procedure. Results of these tests showed that two weeks after injection, significantly more cells remained in place when delivered within the biomaterial suspension in comparison to the traditional liquid suspension. In current cell therapy procedures, it was found that all injected cells migrate away from the injected site on the intervertebral discs within 4 days, which makes this result a significant step forward in effectively treating degenerative disc disease with injectable cell therapy.



IV. Discussion

These results are preliminary, and it is very clear that there is much more work to be done in order to optimize this treatment for practical use on humans. The injection sites still are not large enough to deliver NP cells to larger IVD sites that are present in humans in comparison to mice. Duke University's biomedical engineering professor Lori Setton said, "The concept is that these cells will be promoted to produce matrix that can support tissue regeneration or arrest degeneration…Additional studies that evaluate disc height or matrix hydration following cell delivery would be important to achieve this goal. There's definitely interest and certainly real potential there."

References

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