Biologic Therapies for Aging Discs

The lines and wrinkles on our faces aren't the only signs of the inevitable aging process. Progressive degenerative changes have also been documented in the spine. One of the areas of great interest is the intervertebral disc. New biologic therapies for aging discs are the subject of this review article on the topic.

There are 33 vertebrae or spinal bones. Between each vertebra is a disc made of tough cartilage with a fluid center. These discs provide the cushion that allows your backbone to bend and twist. Discs also act like shock absorbers as we walk, run, and jump. Each vertebral segment consists of bone next to bone with a cartilage cushion between. They are tied together with connective tissue, ligaments, and tendons.

Degenerative disc disease is an example of something that affects most people as they get older. Everyone is going to have a certain amount of damage to the spine. This occurs throughout a lifetime. The discs can flatten, and protrude from between the bones. In time, most people will have small tears in the outer layers of these discs.

Finding ways to repair damage to the discs is the focus of many research studies. One of the most recent directions in research has been the use of biologic therapies to restore the disc. Examples of these treatment approaches include disc cell reimplantation, stem cell implantation, disc denervation, injection of therapeutic proteins, and gene therapy.

What are these therapies and how do they work? Biologic therapies of this type are meant to help at the cellular level. Scientists have shown that inside the cells of the disc there is a limited amount of blood flow. As a result, there are waste products building up. The cell becomes very acidic and that is a harsh environment that doesn't support cell health very well.

As we age, there are fewer new cells to replace the old. Fluid leaks out of the discs that never gets replaced. We start to lose the strength of the discs needed to cushion and support the spine. A loss of disc height can lead to disc space collapse.

That's what's happening on the inside at the cellular level. On the outside, the affected individual may not feel anything until the degenerative process has gone on quite a while. Eventually, back pain, loss of motion, and loss of function get our attention. By then, there may not be much that can be done to save the disc. Right now, surgery to remove the disc is often the only option.

That could change if any of these biologic therapies can be perfected. Right now they are still in the experimental stages. Most of the studies have been done on animals but a few human trials have been conducted.

For example, disc tissue reimplantation is a process in which a few healthy cells are removed from an intact disc. They are taken to a lab where they can be multiplied and then reinjected into the diseased disc. The hope is that the new, healthy cells will replace the damaged cells and restore the strength of the disc. The problem with this approach is that by removing healthy cells, the healthy disc is damaged and must repair itself.

Stem cells are the basic cells from which all other cells are formed. Attempts to inject stem cells into the disc so that they will form new disc cells have been limited. Remember, the internal cell environment of degenerated disc tissue is acidic and that doesn't support new life very well. The stem cells are often quickly killed.

Disc denervation is a way to stop the pain but doesn't really do anything to change the disc. Radiofrequency and electrotherapy are two ways used to heat up the nerve enough to kill it. But studies comparing these treatment techniques against sham (pretend) treatments have not shown any real advantage of the heat treatment over the sham treatment.

The injection of proteins such as growth factors into the discs has also been tried. It's a fairly simple procedure, which makes it attractive. But again, puncturing the disc to inject the material sets up a painful inflammatory response that is counter productive. Trials in humans are just getting underway so there are no results to report yet using this treatment approach.

And finally, gene therapy has been investigated as a possible form of biologic therapy for degenerative disc disease. No injection is required. The gene is attached to a transportation unit called a vector (like a taxicab driver who takes you where you are going).

Most gene transfer methods use viruses as the vector. This works well to get the gene inside the cell but then the immune system starts to kill off the viral vector. The result may be illness from the virus as well as a die-off of the genes.

Rescuing degenerative discs has not been an easy task. The acidic cells and limited blood supply leave a fairly hostile environment for any of the biologic therapies to try and get a foothold. The chance to produce tissue repair with biologic therapies is promising but not ready yet for use by the general public. As the authors of this review pointed out, we are just starting to move from animal to human studies. Keep watch here and we will keep you informed of their progress!

Reference: Christopher K. Kepler, MD, MBA, et al. Intervertebral Disk Degeneration and Emerging Biologic Treatments. In Journal of the American Academy of Orthopaedic Surgeons. September 2011. Vol. 19. No. 9. Pp. 543-553.