Solving The Problem Of Degenerative Disc Disease

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Some people have degenerative disc disease and don’t even know it. But for others, this disease takes its toll on daily life, affecting mobility and causing debilitating pain. And while DDD is actually more of a condition brought on by the aging process than a disease associated with teenagers, young people are not immune: the increasing use of smartphones is being blamed by doctors for the increase of young patients with slipped discs, [1] and many people experience trauma from accidents early on in their lives that contribute to early onset of the disease.

Degenerative disc disease is a type of osteoarthritis of the spine that can show up anywhere in the spine, but is most prevalent in the lower spine and neck. As we age, the flexible intervertebral discs that sit between our vertebrae grow stiff and hard, losing their flexibility. Because of the micro trauma that can accumulate over time or because of accidents that cause discs to degenerate, these small cartilage discs shrink and flatten; nutrients are unable to reach the discs and the degeneration of the discs continues, causing intense discomfort and pain and often leading to other spinal problems.

Oftentimes patients with DDD seek out non-operative treatments such as physical therapy, chiropractic therapy, acupuncture, steroid injections, and NSAIDs. But for many of the more than 30 million Americans who suffer from DDD, pain is so severe

that non-operative treatments are ineffective and surgery appears to be the only viable option. Some patients' pain is so intense, and their attempts to cure themselves without going under the knife are unsuccessful, they feel like nothing will ever really work.

A number of surgical procedures are currently used to treat DDD, but the most common include anterior cervical disectomy and fusion, where the intervertebrtal disc is completely removed and replaced with a small piece of bone or other graft substitute and the two surrounding vertabre will fuse together. Another procedure, cervical corpectomy [2], involves the removal of one or more of the adjacent vertebral bodies as well as intervertebral discs, in order to allow the spinal cord and nerves to decompress. These solutions provide relief for some but not all patients with DDD. It seems, from the online forums dedicated to conversations about the disease, that for many patients, the unexpected complications from surgery can result in just as much pain and debilitation as the disease itself.

But ongoing research into stem cell therapy [3] provides hope that a solution to our back pain might not lie too far off. Scientists at Duke University are applying stem cell therapy to Degenerative Disc disease by injecting a gel containing protein-filled cells native to the tissue, and allowing them to 'gel' in place, thus essentially pumping the disc back up to its original height and providing added cushioning. Besides avoiding the anesthesia that accompanies surgery, using stem cells to repair interverterveal discs avoids some of the risks that tend to follow traditional surgeries, and the decrease in pain and increase in mobility that would likely come out of this treatment is encouraging.

Speaking of his work, Dr. Bonassar explained that his intent is to "develop a method to repair punctured discs and to develop a tissue engineered IVD as a possible biological replacement option." Replacing the disc involves similar biomaterial as repairing by injection, but the gel would fit into a mold—custom made to fit each patient's physiology—and the cell filled gel would grow in the mold. These engineered discs have already been used for rats in Bonassar's lab. According to the lab, the rats have "lived out the rest of their (admittedly short) lives with complete mobility." So printing these regenerative tissues to repair and replace the inteveterbeal discs of humans—and the prospect of living a pain free and mobile life—is certainly exciting.

Of course, with 3D printing, the medical applications are numerous. Doctors have already saved a baby's life by printing a splint for his trachea [4] when his airway closed, scientists have printed a human vein [5], and others are working to create functioning kidneys. [6]Right now though, the idea that printed human intervertebral discs might be used in the near future seems especially exciting, because this procedure could impact so many people with the condition who struggle to find a treatment that reduces their pain. With all of the support that Bonassar's research is receiving, it seems that it won't be long until we know for sure how well his plans are working and what the future holds for the millions of people whose lives could be changed by his work.

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