Adult Stem Cells for the Treatment of Pain

Regenerative medicine is a game changer in the health industry with the potential to heal damaged tissues and organs. It offers solutions and hope for people who have conditions that today are beyond repair.
Injury, osteoarthritis or degeneration are common causes of severe neck, back and joint pain. Historically, surgical intervention was the only option to treat these conditions until a new, innovative technique was introduced: Regenerative Stem Cell Therapy. An alternative solution to invasive surgery, the therapeutic use of stem cells is now being used worldwide to treat multiple conditions that were once considered to be chronic.

Throughout the world, physicians and researchers are utilizing stem cells to treat and manage chronic diseases such as diabetes, heart failure, and pain due to degenerative nerve, bone and joint conditions. Many patients are opting for stem cell therapy to alleviate pain and slow the effects of degenerative diseases so they can enjoy life’s simple pleasures, from playing a round of golf, to bending down or even sitting in a chair. Most stem cells intended for regenerative therapy are generally isolated either from the patient’s bone marrow or from adipose tissue.

Charles S. Theofilos M.D. is a board certified neurosurgeon and expert in the field of regenerative medicine. He has been utilizing stem cell therapy with his patients for many years in his fusion surgeries and more recently in regenerative treatments for spinal disc and joint degeneration. He has found much success in treating chronic neck, back and joint pain; arthritis and degeneration.

Dr. Theofilos has a unique, three-step approach to prepare the area for stem cells thereby, increasing the cells ability to thrive. The following technique is done in his office procedure suite:

- Dr. Theofilos takes a patient’s own blood and spins it in a special centrifuge to isolate large amounts of a specific protective protein. The isolated enzyme is then injected directly into the patient’s spinal disc or joints to neutralize the bad enzymes and prepare for the arriving stem cells.

- The stem cells harvested from the patient’s own body are then injected into the optimized spinal disc or joints such as the knee, hip or shoulder.

- A specialized mixture of growth factors and proteins that were previously isolated from the patient’s blood is injected, neutralizing the acidity in the body caused by injured joints and discs and improving the regenerative process.

- Today, professional athletes and non-athletes alike are using stem cell therapies to treat acute injuries and speed up the healing process. This pioneering regenerative stem cell therapy shows promise in the reduction of pain and improved quality of life without the need for major surgery.
Alpha-2 macroglobulin is a destructive enzyme (protease) inhibitor produced by the liver, cartilage, and bone cells and is found in our blood, joints and discs at birth.\(^1\) Research studies have demonstrated that Alpha-2 macroglobulin binds to proteases (destructive enzymes) and neutralizes their activity to protect the spine and joints.\(^2\) Alpha-2 also protects the cartilage from protease that can cause inflammation leading to osteoarthritis.\(^3\) As we age, the levels of Alpha-2 decrease in the joints and discs, leaving the destructive enzymes free to destroy cartilage (degeneration).\(^4\) Alpha-2 is concentrated in your blood but when applied to the arthritic joint it may inhibit destruction of the cartilage by reducing inflammation and blocking destructive enzyme activity.\(^5\) Not only can this aid in decreasing pain and inflammation, but it may also slow the normal aging arthritic process down and can help better prepare the spinal discs and joints to achieve an optimal environment for stem cell growth.

In the initial step approximately 60 ml of venous blood is collected from a vein. The collected blood is placed in a special centrifuge and then filtered to concentrate and isolate the Alpha-2 macroglobulin molecule. Once the Alpha-2 protein is collected, it is then prepared for injection into the site causing the pain. Under live x-ray fluoroscopy a needle is placed into your joints or spinal disc and the Alpha-2 macroglobulin is injected into the affected area. The entire procedure takes approximately 30-45 minutes.

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1. Borth, Wolfgang, Department of Medicine, Mount Sinai School of Medicine, New York, NY. Abstract: Alpha-2 Macroglobulin, a multifunctional binding protein with targeting characteristics.
2. Cuellar MD, Jason; Cuellar MD, Vanessa; Browning PhD, Shawn; Scuderi MD, Gaetano; Golish MD, Raymond; and Hanna PhD, Lewis S. Is there a Chondroprotective Effect of Autologous Protease Inhibitor Concentrate on an Osteoarthritis Model? Pilot Study.
**Step Two - Autologous Mesenchymal Stem Cells (MSCs)**

Autologous Mesenchymal Stem Cells (MSCs) can be isolated from bone marrow aspirate (BMA) and adipose tissue (fat). These type of stem cells are reported to be safe with very little chance of rejection and do not undergo malignant transformation. MSCs possess the capacity for self-renewal and have the ability to form different cell types.\(^1\) Mesenchymal stem cells implantation in animal models have resulted in increased proteoglycan content with partial restoration of disc height and hydration; restoration of disc extracellular matrix where the cells live and improvement in x-ray and disc height at six months.\(^2\)

Adipose tissue can be composed of three types of fat: white, brown, or mammary. White fat contains both hematopoietic (blood) and mesenchymal stem cells and can transform into numerous types of cells including: blood vessel, fat, heart, liver, pancreas, bone, muscle, nerve and cartilage cells. Furthermore, adipose tissue produces a scaffold for stems cells to promote growth.\(^3\)

In a recent pilot study, ten patients diagnosed with degenerative disc disease between the L4-S1 were treated with MSCs. Improvement in pain occurred in 71% of patients, of which 85% of the pain improvement was in the first three months. The fluid content of the affected disc segments were significantly elevated at one year after stem cell therapy.\(^4\) Another study injected 2-3 ml of bone marrow concentrate into asymptomatic lumbar discs of 26 patients who were surgical candidates. Twenty one of the twenty six patients demonstrated statistically significant improvement in pain within 14 days. Ultimately, only two of the 26 patients opted for surgical intervention.

This second step in the procedure begins with aspiration under local anesthesia. A small needle is used to withdraw approximately 60 ml of bone stem cells from the top of the hip bone and approximately 30 cc’s of localized adipose tissue. This process takes several minutes and is done under x-ray fluoroscopy. The stem cells are purified and then injected into the area of pain. This procedure attempts to restore the body with normal healthy cells to reduce pain.

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1 Orozco, Luis; Soler, Robert; Morera, Carles; Alberca, Mercedes; Sanchez, Anna and Garcia-Sancho, Javier. Intervertebral Disc Repair by Autologous Mesenchymal Bona Marrow Cells: A Pilot Study. Transplant Journal. Vol. 92, Num. 7, 2011.


3 Yim, RL; Lee, JT; Bow, CH; Meij, B; Leung, V; Cheung, KM; Vavken, P; and Samartzis, D. A Systematic Review of the Safety and Efficacy of Mesenchymal Stem Cells for Disc Degeneration: Insights and Future Directions for Regenerative Therapeutics. Stem Cells Dev. Nov. 2014

4 Pettine, Kenneth A.; Murphy, Matthew B.; Suzuki, Richard K.; and Sand, Theodore T. Percutaneous Injection of Autologous Bone Marrow Concentrate Cells Significantly Reduces Lumbar Discogenic Pain through 12 Months. Stem Cells. 2014
PRP is a process in which the patient’s own blood is highly filtered to isolate a plasma rich solution containing platelets, growth factors and proteins which can promote tissue healing while reducing inflammation and pain.¹ This booster supply of platelets to your injured site will enhance your own body’s natural healing process.² PRP has been used successfully in numerous musculoskeletal conditions that affect injured joints, tendons, ligaments and cartilage.³ When acting as a booster for stem cell growth, this process can aid in the natural development of previously injected stem cells by supplying them with healthy growth factors and proteins.⁴

Within the first three days after the injection, an influx of platelets removes dead tissue, releases cytokines and growth factors which allows for vessel ingrowth. Cytokines are cell signaling molecules that aid cell to cell communication in immune responses and stimulate the movement of cells towards sites of inflammation, infection and trauma. At six weeks after injection, increased collagen is produced with vessel growth and initial formation of healed tissue.

This third procedure involves drawing approximately 60 ml of blood from a vein. This sample is then placed in a specialized centrifuge machine to concentrate and isolate a PRP suspension. Under direct X-ray, several cc’s of concentrated suspension is injected into the injured joint or disc. This booster dose promotes tissue healing and maximizes repair.

Frequently Asked Questions

Where do adult stem cells come from?
In adults, stem cells are present within a variety of tissues and organs, the most common sources being bone marrow and fat (or adipose) tissues.

How do adult stem cells know what type of tissue to develop into?
The differentiation of adult stem cells is dependent on many factors, including cell signalling. For example, adult stem cells delivered to damaged bone can develop into bone cells or spinal discs/joints to develop into cartilage to aid in tissue repair.
How are adult stem cells obtained, prepared and delivered?
One of the richest sources of adult stem cells is bone marrow and fat, and the hip and adipose tissue are the best and most convenient locations for obtaining bone marrow and fat stem cells. In the harvesting procedure, Dr. Theofilos will aspirate them from the pelvis and local fat tissue and use specifically designed equipment to concentrate them for injection into the site of injury or point of care.

Will my body reject the adult stem cells?
No, usually since they are your own cells collected from your tissue there is little chance of rejection.

Does smoking or drinking affect the therapy?
Alcohol consumption and cigarette smoking can both be detrimental to the therapy. It is highly advisable that patients do not drink or smoke.

What are some conditions that would benefit from stem cell therapy?
There are many potential applications where stem cell treatments can be very effective including the following: discogenic back pain, facet arthritis, degenerative disc disease, osteoarthritis, hip injuries, shoulder tears, knee tears and foot/ankle inflammation/tears.

Will insurance cover stem cell therapy?
While adult stem cells have been used for decades to treat a variety of diseases, their application in the treatment of pain is relatively new. Because of this, insurance companies do not currently cover the therapy.

How much does stem cell therapy cost?
The cost of a stem cell treatment differs based on the procedure performed. The cost of treatment includes consultation, treatment itself, medical examinations, tests and injections. An average cost can vary from $3,000 per step for joints and $5,500 per step for spine and neck.
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