Delivery and attachment systems for repairing reherniated intervertebral discs (2022-007)

Mechanisms that aid in attaching a previously invented repair patch during surgery to treat recurrent herniation

Market Overview

These mechanical attachments systems can help repair discectomy patients' reherniated intervertebral disc (IVD) post-surgery and promote natural tissue healing. Nearly 400,000 discectomies are performed each year in the US to remove herniated IVD tissue fragments. However, reherniation is the most common complication from these surgeries, which causes pain and significant additional costs. A study found in *The Spine Journal* estimates that 7-18% of discectomy patients experience this complication. The current devices being used to treat recurrent herniations often have detrimental impacts on the IVD and adjacent vertebrae. Clemson University researchers have developed new delivery and attachment systems for a previously invented collagen-based patch that promotes natural healing of the IVD. These systems allow the patch to be anchored into the soft tissue and provide optimum coverage compared to other market devices.

Technical Summary

These delivery and attachment systems are designed for more efficient employment of a repair device for recurrent herniation. Previous methods involve placement of the device either in or over the defect and then securing the patch/plug in place using an anchor constructed of a T-bar, suture, or the combination of the two. In contrast, this method applies the sutures/anchors first before being used to guide and secure the device into place. This technique employs mechanisms that can securely position the device, allowing natural tissue healing to occur. One of the delivery systems contains a cannula with multiple flexible arms that can attach to the annulus fibrosus repair patch (AFRP) and deliver it to the herniation site. The flexibility of the AFRP and the arms of the delivery device allow these components to be compressed and loaded within the cannula. Once at the desired anatomic location within or outside of the herniated IVD, the delivery system can be activated. The flexible arms with the attached AFRP are then deployed outside of the cannula, which allows for the expansion of the AFRP and its subsequent mechanical attachment to the IVD. There is additionally an AFRP that has a connected plug, which can be used in conjunction with the patch and attachment mechanisms to fill the void space in the inner annular region that typically remains following herniation. Also, there is a strut-style AFRP that is expandable so that the AFRP can be delivered in a minimally invasive fashion. Once in place, it can be expanded and held in this position while anchoring it to the interior aspects of the IVD. This includes using an anchor system to attach and secure the AFRP into the anterolateral or lateral wall of the native annulus fibrosus, where more healthy tissue can be found to support anchoring.

Application

Annular repair, Recurrent herniation, Discectomy, Biomedical, Mechanical systems

Development Stage

Prototype

Advantages

- Expandable systems, leading to more natural tissue healing and providing a long-lasting solution for patient pain prevention
- Durability in placement, allowing for patch to be placed both on the inside and/or outside of the herniated IVD
- Minimally invasive approach, creating optimum coverage past nerve bundles, which is normally restrictive with current market designs

App Type	Country	Serial No.	Patent No.	CURF Ref. No.	Inventors
Provisional	United States	63/253,419	NA	2022-007	Dr. Jeremy Mercuri

About the Inventor

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Dr. Jeremy Mercuri earned his Ph.D. in Bioengineering from Clemson University. Prior to joining Clemson, he was a senior research engineer at Stryker Orthobiologics and a research engineer at Medtronic Spinal & Biologics. Among his accomplishments, Dr. Mercuri holds two issued patents and several applications in prosecution. He founded the Laboratory of Orthopaedic Tissue Regeneration and Orthobiologics at Clemson in August 2013 where he focuses on the development of regenerative medicine technologies. His research expertise lies in biomaterials development and the application of stem cells towards orthopaedic tissue engineering and regenerative medicine.

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