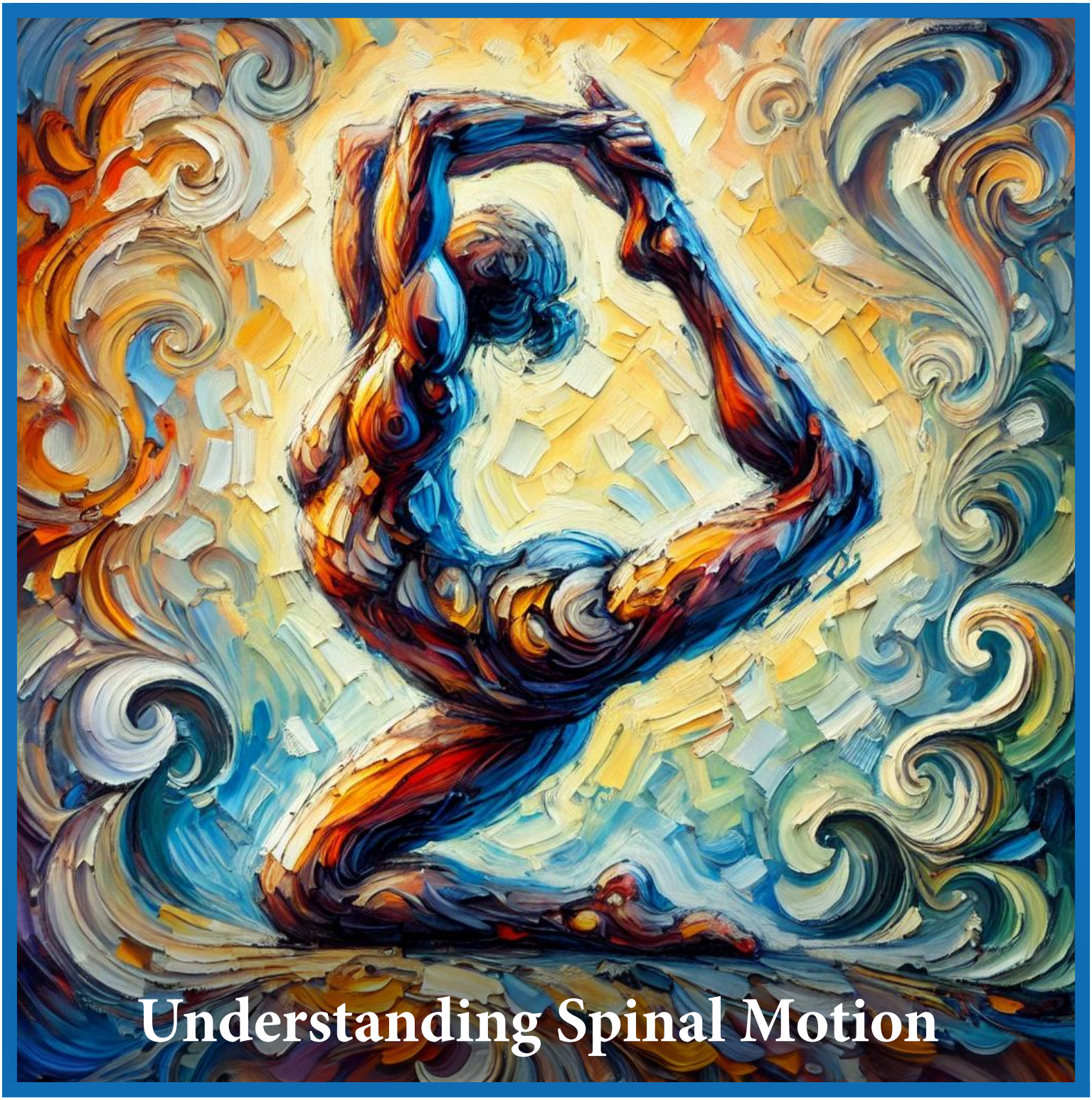
Fall 2024

The Spine Health Journal

National Spine Health Foundation



Understanding Spinal Motion

Guest Editors: Domagoj Coric, MD & Richard Guyer, MD

NATIONAL SPINE HEALTH FOUNDATION

The National Spine Health Foundation is a 501(c)(3) nonprofit public charity dedicated to improving spinal health care through patient education, patient advocacy, and clinical outcomes research. Our work, including the publication of The Spine Health Journal, is made possible by the generous support of individuals, corporations, and foundations who believe in our mission.

We extend our heartfelt gratitude to the members of the Spine Health Leadership Council including **Globus Medical**, **Highridge Medical**, and **Orthofix**. Their philanthropic contributions play a crucial role in our efforts to educate the public with unbiased, expert-driven resources, and to support patients on their journey to spinal health.

This edition of the Spine Health Journal aims to provide a deeper understanding of spine care technology and techniques, serving as a bridge toward knowledge and hope for those suffering from spine problems.

National Spine Health Foundation
11800 Sunrise Valley Drive Suite 330
Reston, VA 20191
Phone: (703) 766-5405
Email: info@spinehealth.org

02 **Introduction**

03. A Message from the CEO
05. Letter from the Guest Editors

07 **Section 1**

08. The Backbone of Health: Understanding Spinal Motion
10. Common Conditions That Hinder Spinal Motion

12 **Section 2**

13. A Comprehensive Overview: Cervical Arthroplasty Explained
16. A Comprehensive Overview: Lumbar Arthroplasty Explained
18. Moving Forward: Why Motion-Sparing Spine Surgery is a Game Changer

20 **Section 3**

21. Breaking Through Barriers: Overcoming Insurance Challenges for Disc Replacement
24. From Rigid to Resilient: The Evolution of Motion-Preserving Spine Procedures
26. Disc Arthroplasty 101: Answers to Your Most Frequently Asked Questions

28 **Section 4**

29. Patient Story: Jenna Bendinelli

31 **From the Research Institute**

32. Strong Spine, Strong Future: How Young Adults Can Preserve Spinal Motion for Life

36 **Chairman's Note**

38 **About Our Authors**

43 **Medical & Scientific Board**

NATIONAL SPINE HEALTH FOUNDATION

Introduction

03. A MESSAGE FROM THE CEO

05. LETTER FROM THE GUEST EDITORS

A message from the CEO

Rita Roy, MD

A body in motion stays in motion. Sir Isaac Newton's first law of motion, developed in the 1700's, is a fundamental physics principle to describe many aspects of our world. This concept can also be applied to a fundamental principle about our bodies: what is meant to move, should continue to move. The goal of spinal wellness is to keep our spines moving, as it was designed to move. Staying in motion allows us to live well for as long as possible.

Artificial disc replacement (ADR) is one of the greatest innovations in modern spinal health care. Artificial discs have been developed, tested, and successfully used for more than twenty years in the US. ADR allows the spine to maintain its motion and thus provides superior results for the right patient performed by a well-trained spine surgeon. While ADR gives excellent results, there are several reasons why people might be confused or uncertain about this procedure.

1 **Lack of Awareness:** Many people are simply not familiar with ADR as a treatment option. Traditional treatments like spinal fusion are well-known and have been around for much longer.

2 **Complexity of the Procedure:** The spine is a complex structure, and understanding how artificial discs are implanted can be challenging for non-medical individuals. The idea of replacing a natural disc with an artificial one can be difficult to grasp.

3 **Mixed Information:** There is a variety of information available about ADR, and not all of it is consistent. Different sources may offer conflicting opinions on the efficacy, risks, and benefits of the procedure, leading to confusion.

4 **Medical Jargon:** Medical explanations often involve technical language that can be hard for the average person to understand. Terms like "lumbar", "cervical", "prosthesis", "motion-sparing" and "biomechanics" can be intimidating.

5 Varied Outcomes: The success and satisfaction rates of any surgery can vary based on several factors, including the patient's condition, the surgeon's experience, and the specific details to each procedure.

6 Insurance and Cost: Insurance coverage for ADR can be inconsistent, and the cost of the procedure can vary. Understanding what is covered and what is not can be perplexing.

7 Rapid Advancements: The field of spine surgery is rapidly evolving, with new technologies and techniques being developed. Keeping up with these changes can be difficult for patients and healthcare providers.

8 Comparisons to Other Treatments: People may be confused by how ADR compares to other treatments like spinal fusion, physical therapy, or pain management. Each option has its own pros and cons, and understanding these nuances requires careful consideration.

9 Individual Differences: The suitability of ADR can vary greatly from person to person. Factors such as age, overall health, bone health, the specific spinal issue, and previous treatments all play a role in determining whether ADR is an option.

10 Long-Term Data: While there is growing evidence supporting ADR that has been building over the past 20 years, data continues to be collected, contributing to hesitancy among some individuals.

Addressing these sources of confusion will require clear, accessible information from expert healthcare providers. The need for unbiased, truthful and understandable patient education and support has never been more important than it is now for helping people learn about the promise of this amazing new technology. Artificial discs can preserve the natural motion of the spine, and thereby extend life.

Letter From the Guest Editors

Richard Guyer, MD
Texas Back Institute

Domagoj Coric, MD
Atrium Health Spine Center of Excellence

In the last 20 years, spinal motion preservation is one of the most rapidly advancing surgical fields. Similar to the evolution from hip joint fusion to total hip replacement for the treatment of hip arthritis, the replacement of degenerative spinal discs with artificial discs is a modern approach to the traditional fusion option. Many experts feel that cervical artificial disc replacement is becoming a new “gold standard” for common neck disorders, and there is a growing body of evidence supporting this.

Since the introduction of modern day lumbar artificial disc replacement (L-ADR) to the US in 2000 and cervical artificial disc replacement (C-ADR) a few years later, they are quickly gaining acceptance. Over the ensuing twenty years, sixteen different spinal motion preservation devices have received FDA-approval: 12 cervical artificial discs, 3 lumbar artificial discs, and the first artificial facet replacement device in 2023. These devices were found to be as good as or better when compared to standard fusion procedures in FDA clinical trials. Both C-ADR and L-ADR are FDA-approved for 1-2 level surgeries in the neck and low back.

C-ADR was compared to the most performed fusion procedure worldwide, anterior cervical discectomy and fusion (ACDF), where motion is eliminated at the treated spinal segment. ACDF and C-ADR are similar procedures with nearly identical neck incisions, exposure, and disc removal. Following freeing up the nerves and/or spinal cord, the space between the bones where the damaged disc was removed must be filled with something. In the fusion procedure (ACDF), the space is filled with materials for fusion to eliminate motion. However, in disc replacement surgery (C-ADR), the space is filled with an artificial disc that maintains neck motion and does not place extra stress on the discs above or below.

Some of the most common C-ADR devices used include the Simplify Disc, Mobi-C, M6-C, Prodisc C and Prestige LP. An additional two cervical artificial discs, Baguera C and the Synergy Disc, have completed study enrollment and are awaiting FDA approval. Each artificial disc utilizes different materials and designs with their own unique advantages. Yet, they all have one thing in common, maintenance of motion.

L-ADR is used to treat low back pain caused by a damaged disc that is severe and does not improve with non-surgical management including physical therapy and medications. Disc replacement is an exciting option for those suffering from low back pain. The lumbar disc is approached and removed through an abdominal incision in the front of the body. There are two lumbar artificial discs that are cleared for use in the US, Prodisc-L and activL.

The future of spinal motion preservation is bright as technology continues to advance. Spinal motion at each segment is achieved by the disc and facet joints. In addition to disc replacement options, research and development is now incorporating the facet joints into the motion preservation space. Just last year, a new era in spinal motion preservation began with the first FDA-approved lumbar artificial facet replacement device, the TOPS System. TOPS was found to have superior results compared to a common lumbar fusion procedure, transforaminal lumbar interbody fusion (TLIF). A second new device, MOTUS, has already completed enrollment of its FDA trial and is actively seeking FDA-approval. This device addresses both the disc and facet joints as part of the surgery, as the first total joint replacement for the low back.

Each artificial disc utilizes different materials and designs with their own unique advantages. Yet, they all have one thing in common, maintenance of motion.

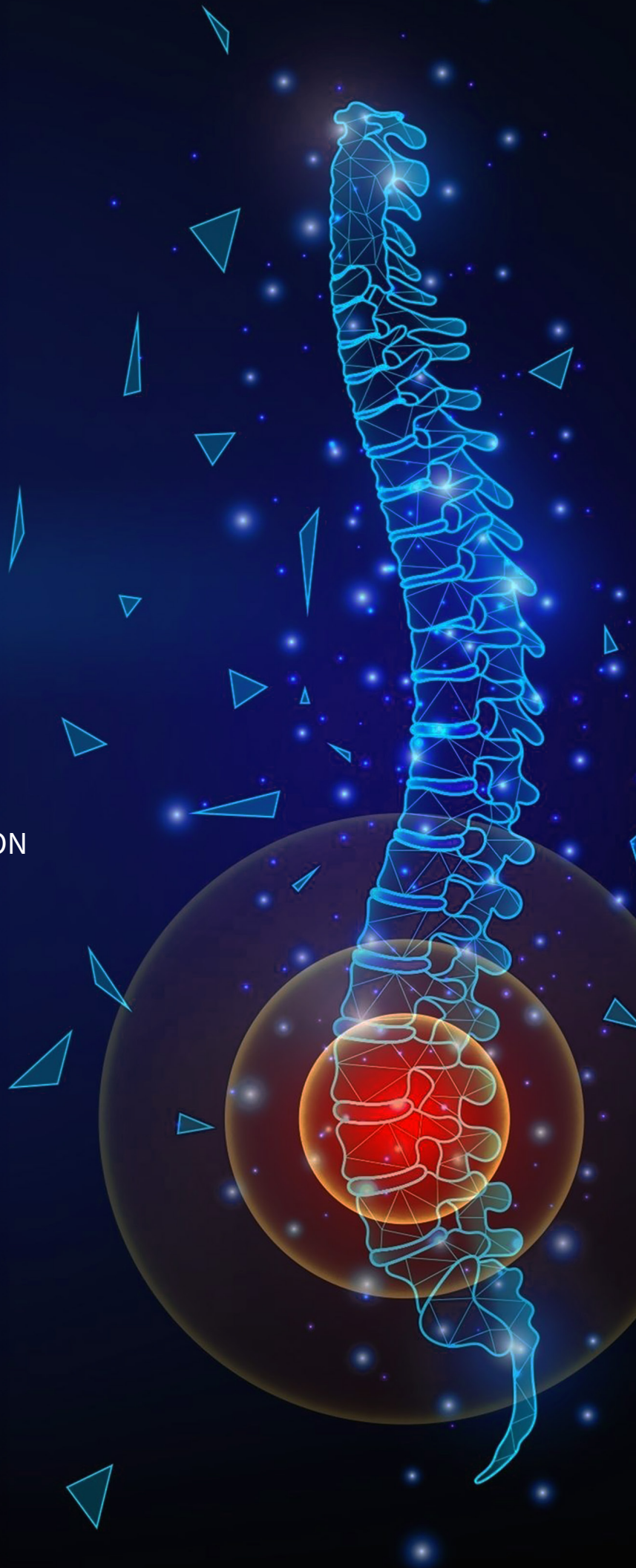
The field of spinal motion preservation has evolved with modern artificial discs composed of new materials with better wear characteristics and radiographic imaging. Improvements in disc design have resulted in devices that more closely mimic natural motion. We are fortunate to have some of the world's leading experts in spinal motion surgery contributing to this journal issue. They will discuss these topics and more, sharing their insights in the exciting world of spinal motion preservation.

NATIONAL SPINE HEALTH FOUNDATION

Section 1

08. THE BACKBONE OF HEALTH: UNDERSTANDING SPINAL MOTION

10. COMMON CONDITIONS THAT HINDER SPINAL MOTION



THE BACKBONE OF HEALTH:

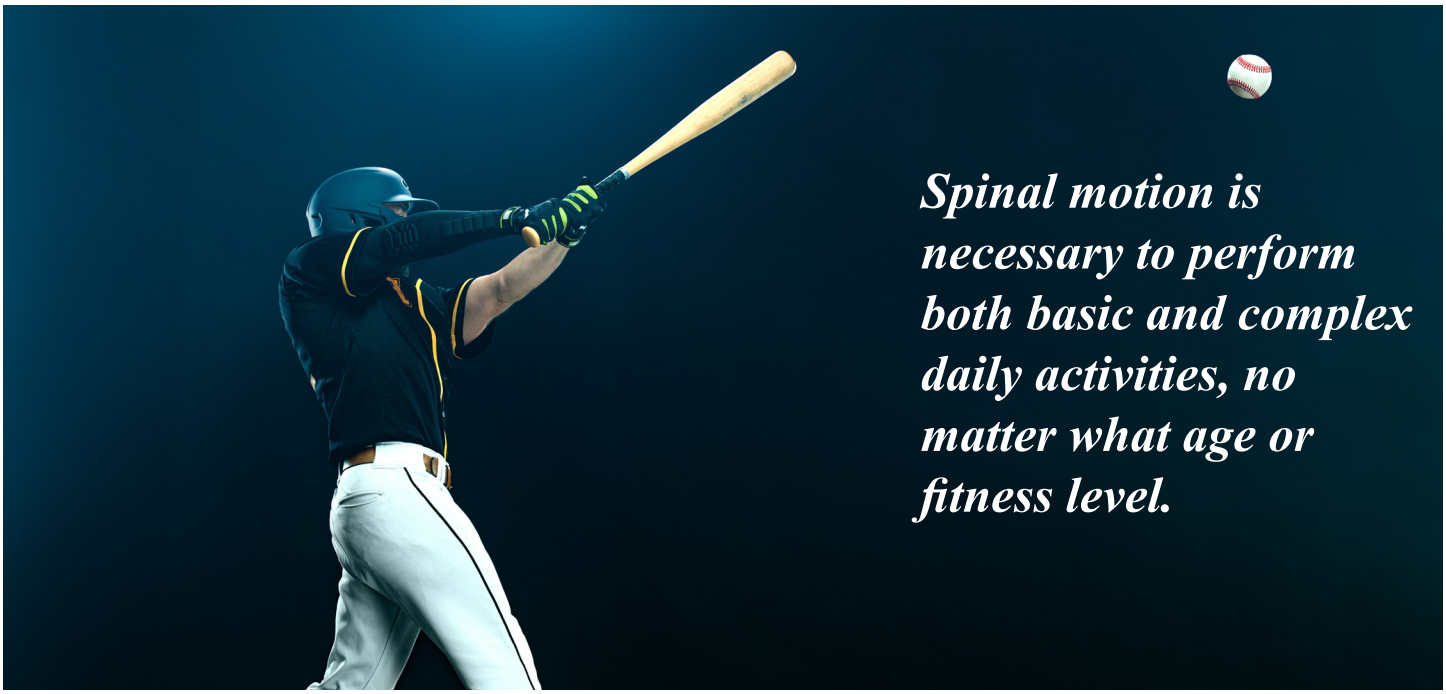
Understanding Spinal Motion

Luis Manuel Tumialán, MD
Barrow Brain and Spine

A centerfielder hears the crack of the bat, then looks up to track and catch the baseball soaring through the air. A young mother responding to her crying newborn, leans over the crib to lift her crying infant up, who is instantly soothed by her embrace. A grandmother sees a package on her doorstep sent by her grandchildren, and bends over to pick it up to open a delightful birthday gift. All of these important actions involve motion of our bodies and of our spines. Spinal motion is central to our everyday lives and easy to take for granted. This article will begin to explore the significance of spinal motion.

The centerfielder is unknowingly employing the full range of motion of his cervical spine (neck) to track down that fly ball. He effortlessly looks up with the 70-80 degrees of extension inherent to his cervical spine and turns his head as he tracks down the baseball with up to 90 degrees of rotation on both sides. At his next at bat, his cervical spine can achieve 80-90 degrees of downward motion to keep his head flexed when he swings to drive the baseball into the outfield. In a similar manner, the young mother is using her 50 degrees of flexion along with 5 degrees of rotation inherent to her lumbar spine (low back) to bend over and pick up her crying infant. Likewise, the grandmother can retrieve her birthday present by bending at the waist using 48 degrees of spinal motion.

Whether catching a baseball, soothing a baby, or picking up a birthday gift off the ground, none of those activities would be possible without spinal motion. Spinal motion is necessary to perform both basic and complex daily activities, no matter what age or fitness level. Therein lies the importance of understanding spinal motion and the importance of preserving that motion throughout our lives. In this issue of *The Spine Health Journal*, each author will focus on the technology available today to ensure that the spine can continue to move throughout our lives.



The desire to preserve motion in the cervical and lumbar spine is not a recent aspiration. As early as 1966, Swedish surgeon Dr. Ulf Fernström recognized the importance of preserving motion and made the first attempt at spinal arthroplasty when he implanted a steel ball bearing in both the cervical and lumbar spinal regions. Remarkably, Fernström implanted 191 lumbar and 13 cervical steel ball bearings before it became apparent that preserving motion in the spine was more complex than placement of a sphere. While the Fernström ball was relegated to the dust heap of history, it was the opening salvo against fusion. Spinal fusion is a motion-eliminating surgery. Spine surgeons would spend the next several decades understanding spinal motion and continue to explore the biomechanics of the spine as they refined their understanding of alloys and polymers that would lay the path for modern day artificial discs.

The importance of spinal motion cannot be overstated and must be preserved when possible. Today, patients have several options for motion preservation in the lumbar and cervical spine. In 2024, we now have the benefit of almost 20 years of outcome data that compare motion preservation to fusion. There is one consistent theme that unsurprisingly surfaces across all studies regardless of arthroplasty device: preservation of motion results in the need for less surgery in the subsequent years and decades that pass. Spine surgeons are now being trained with a mentality that places motion preservation as a priority with a full armamentarium available to accomplish that goal. This journal issue will explore the various technologies that allow spine surgeons to preserve spinal motion, enabling that centerfielder, young mother, and grandmother to continue using the motions of the spine that make life worth living.

[1] Swartz EE, Floyd RT, Cendoma M. Cervical spine functional anatomy and the biomechanics of injury due to compressive loading. J Athl Train. 2005 Jul-Sep;40(3):155-61. PMID: 16284634; PMCID: PMC1250253.
[2] McGregor AH, McCarthy ID, Doré CJ, Hughes SP. Quantitative assessment of the motion of the lumbar spine in the low back pain population and the effect of different spinal pathologies of this motion. Eur Spine J. 1997;6(5):308-15. doi: 10.1007/BF01142676. PMID: 9391800; PMCID: PMC3454599.
[3] Baaj AA, Uribe JS, Vale FL, Preul MC, Crawford NR. History of cervical disc arthroplasty. Neurosurg Focus. 2009 Sep;27(3):E10. doi: 10.3171/2009.6.FOCUS09128. PMID: 19722812.

Common Conditions That Hinder Spinal Motion

Armen Khachatryan, MD
The Disc Replacement Center

Basic Anatomy of the Spine

The human spine, or backbone, is a marvel of engineering, providing both stability and flexibility to our bodies. It consists of 33 vertebrae stacked one on top of the other, divided into five regions: cervical (neck), thoracic (mid-back), lumbar (lower back), sacral, and coccygeal (tailbone).

Each vertebra is cushioned by intervertebral discs, which act as shock absorbers, allowing for smooth and pain-free movement. The disc is made up of a thick outer layer called the annulus fibrosus and an inner cushion called the nucleus pulposus. The spine's ability to flex, twist, and support weight is crucial for daily activities, from bending to pick up objects to turning our heads.

Spinal Conditions That Limit Motion

Several conditions can impair spinal motion, leading to discomfort and reduced quality of life. These include disc degeneration, facet hypertrophy/degeneration, osteophyte formation, and neural compression.

Maintaining spinal health is essential for preserving motion and quality of life.

1 **Disc Degeneration:** Intervertebral discs are gel-like cushions between the vertebrae that provide flexibility and absorb shock. Over time, these discs can wear down, losing their height and elasticity. This condition is known as disc degeneration. This can lead to pain and reduced range of motion, as the discs no longer function effectively.

2 **Facet Hypertrophy/Degeneration:** Facet joints are small joints located between and behind adjacent vertebrae. They help guide and limit the movement of the spine. With age or repetitive strain, these joints can become enlarged (hypertrophy) or worn out (degeneration), causing stiffness, pain, and restricted motion.

3 **Osteophyte Formation:** Osteophytes, commonly known as bone spurs, are bony projections that form along the edges of bones. They often develop in response to joint damage caused by conditions like osteoarthritis. In the spine, osteophytes can reduce the space available for spinal nerves, leading to pain and restricted motion.

4 **Neural Compression:** The spinal column surrounds and protects the spinal cord, and individual spinal nerves pass through openings in the vertebrae. Conditions like disc herniation (disc material protrudes out) or spinal stenosis (narrowing of the spinal canal) can compress these nerves. This compression can cause pain, numbness, and weakness, severely limiting function.

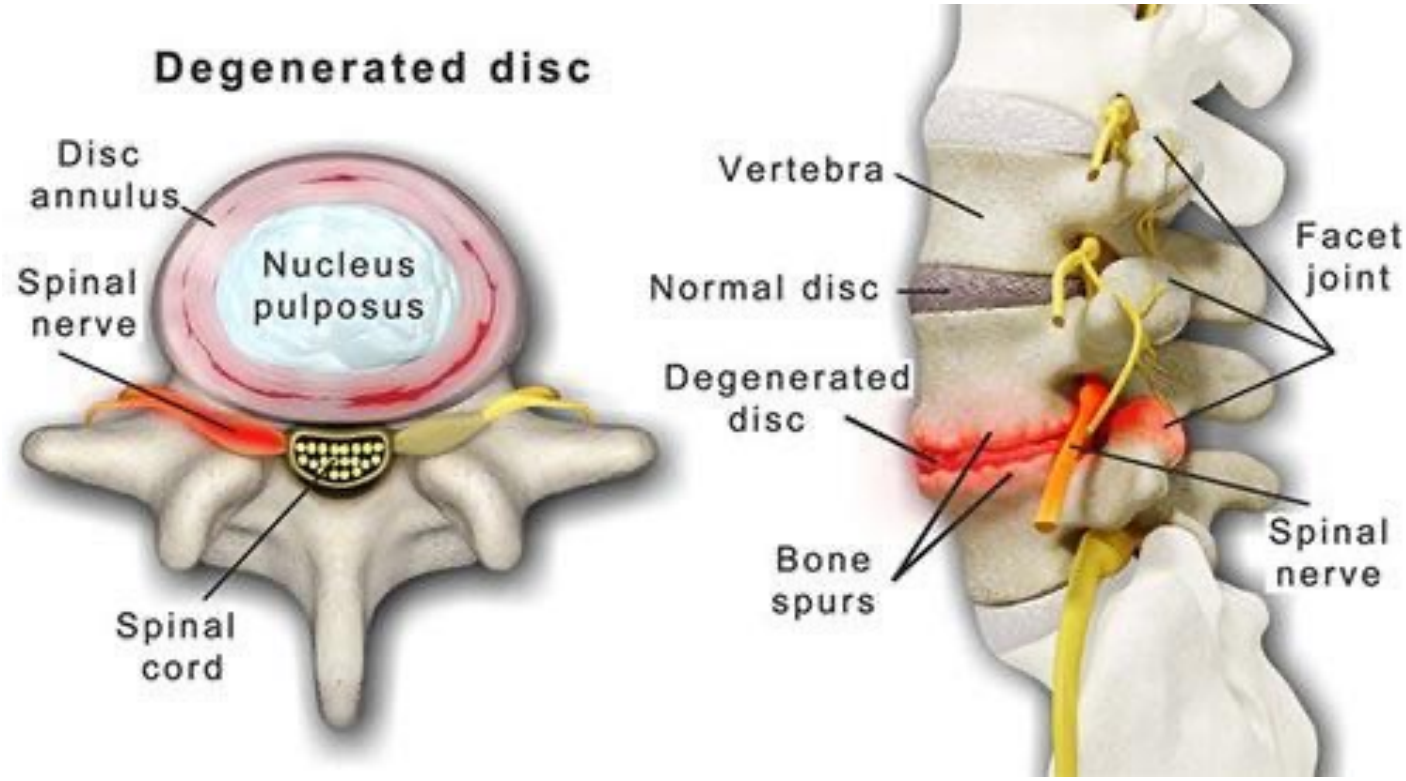


Image of Spinal anatomy, disc degeneration and nerve compression

Common Causes of Spinal Conditions

Understanding the causes of these spinal conditions can help in their prevention and management. The most common causes include:

Age: As we age, the components of our spine undergo natural wear and tear. The intervertebral discs lose water content, becoming less flexible and more prone to degeneration. Similarly, the facet joints can develop arthritis, leading to pain and stiffness.

Overuse: Repetitive motions or heavy lifting can strain the spine, leading to conditions like disc degeneration and facet joint problems. Athletes and individuals with physically demanding jobs are particularly at risk.

Genetic Predisposition: Some people are more prone to spinal conditions due to their genetic makeup. A family history of spinal problems can increase the likelihood of developing similar issues.

Lifestyle Choices: Certain lifestyle factors can contribute to the development of spinal conditions. Poor posture, obesity, smoking, and lack of physical activity can all negatively impact spinal health. For instance, excess weight puts additional strain on the spine, and smoking reduces blood flow to the discs, accelerating degeneration.

Conclusion

Maintaining spinal health is essential for preserving motion and quality of life. Understanding the basic anatomy of the spine and the conditions that can affect it helps in recognizing the importance of preventive measures and seeking appropriate treatment when necessary. Age, overuse, genetic predisposition, and lifestyle choices all play significant roles in spinal health. By adopting healthy habits, such as regular exercise, maintaining a healthy weight, and avoiding nicotine, we can support our spine's function and reduce the risk of debilitating conditions.

NATIONAL SPINE HEALTH FOUNDATION

Section 2

13. A COMPREHENSIVE OVERVIEW: CERVICAL ARTHROPLASTY EXPLAINED

16. A COMPREHENSIVE OVERVIEW: LUMBAR ARTHROPLASTY EXPLAINED

18. MOVING FORWARD: WHY MOTION-SPARING SPINE SURGERY IS A GAME CHANGER

A COMPREHENSIVE OVERVIEW

Cervical Arthroplasty Explained

Hyun Bae, MD
Cedars-Sinai

Cervical arthroplasty, or artificial cervical disc replacement (CDR), is an advanced surgical procedure aimed at alleviating neck pain and restoring mobility by replacing damaged or degenerated cervical discs with a mechanical prosthesis. This procedure has gained popularity as an alternative to the traditional anterior cervical discectomy and fusion (ACDF), especially for patients seeking to maintain motion in their cervical spine.

Terminology

CDR, ADR-C, TDR-C are used to refer to artificial disc replacement surgery in the cervical spine (neck region).

When to Consider CDR

Cervical arthroplasty is typically considered when nonoperative treatments for neck pain and associated symptoms have failed for greater than 6 weeks. A thorough evaluation by a spine specialist, including imaging studies like x-rays, MRI, or CT scans, is essential to determine if cervical arthroplasty is appropriate. Indications for cervical arthroplasty include:

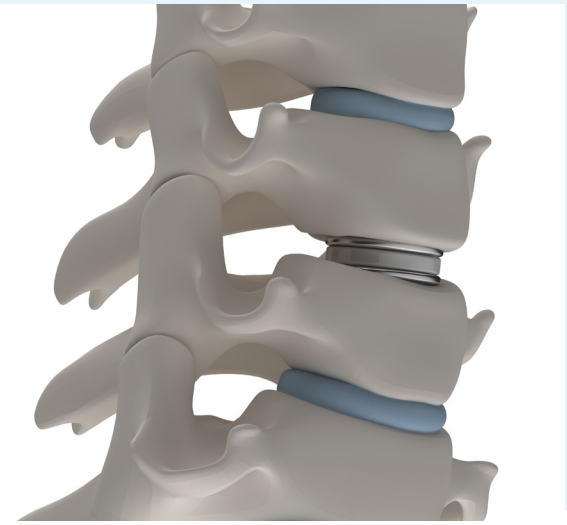
- **Neurological Symptoms:** Numbness, tingling, or weakness in the arms or hands due to nerve compression.
- **Persistent Pain:** Chronic neck pain that does not respond to physical therapy, medications, or other non-surgical treatments.
- **Spinal Cord Compression:** Symptoms of myelopathy, such as difficulty walking, balance issues, or hand dexterity problems.

Basics & Benefits of the CDR Procedure

The CDR procedure involves removing the damaged cervical disc and replacing it with an artificial disc implant. This surgery is performed under general anesthesia and typically involves the following steps:

- **Incision:** A small incision is made in the front of the neck.
- **Disc Removal:** The damaged disc is carefully removed to decompress and free the spinal cord and nerve roots from pressure due to degenerating disc tissues or bone.
- **Implant Placement:** An artificial disc, designed to mimic the natural movement of a healthy disc, is inserted into the disc space after vertebral endplates are prepared to receive it.
- **Closure:** The incision is closed, and the patient is taken to the recovery room.

The primary benefit of CDR over ACDF is the preservation of motion at the operated level, which may reduce the risk of adjacent segment degeneration, a condition where discs above or below the surgical site deteriorate over time. Also, a shorter healing time is required for CDR than ACDF which requires time to achieve bony union of vertebrae across the entire disc space.



The CDR procedure has gained popularity as an alternative to the traditional anterior cervical discectomy and fusion (ACDF), especially for patients seeking to maintain motion in their cervical spine.

Implant Differences and FDA Approvals

Artificial cervical discs vary in materials and design. Device surface endplates are sprayed with titanium plasma to aid with integration to adjacent cervical vertebral bony endplates.

The most common materials used are:

- Medical-grade metal alloys (such as titanium or cobalt-chromium)
- Polyethylene (a durable plastic)
- Medical grade thermoplastic with a zirconia-toughened alumina ceramic core.

Implant designs can differ on:

- The type of articulation, ranging from ball-and-socket to more constrained designs (movement in one or more directions)
- The material properties, where less dense metals or non-metals yield less visual obstruction on x-rays, MRIs, and CTs.

Several artificial cervical discs have received FDA approval for use in the United States. Notable examples include:

- **Prodisc C:** One of the first artificial discs approved by the FDA, composed of two components featuring a ball-and-socket design, with a keel on the superior and inferior endplate to allow bone growth from endplates to secure the device allowing natural motion. Components are Cobalt chrome alloy and ultra-high molecular weight polyethylene inlay. It is used to replace a disc between C3 to C7. FDA approval December 2007.
- **Mobi-C:** Approved for use at one or two levels of disc, offering a mobile core design that allows for a range of controlled motion. It has a keelless design which allows easier insertion. It is also the first device approved for one- and two-disc levels of the cervical spine. FDA approval August 2013.
- **Prestige LP:** Made of a metal-on-metal design, it is made with a titanium carbide alloy that provides improved MRI visualization over cobalt chrome alloy. It is a two-piece ball and trough configuration. It is approved for one- and two-disc levels of the cervical spine. FDA approval August 2013.
- **M6-C:** Is the only one-piece disc replacement with a compliant polycarbonate urethane (PCU) polymer core between two titanium endplates and a PCU and fiber-based sheath which mimics the natural disc structure. The endplates are

coated with titanium plasma spray. This device provides progressive resistance to motion in all six degrees of freedom. It is approved for replacement for one disc level in the cervical spine between C3 to C7. FDA approval February 2019.

- Simplify Disc: Consists of thermoplastic polymer endplates and a ceramic core. It provides a low-profile option for patients with specific anatomical needs. Due to its use of non-metallic components, it has the advantage of allowing visibility of the spine on x-ray and MRI without metallic obstruction. It is approved for replacement at one or two discs of the cervical spine between C3 to C7. FDA approval April 2021.

Inclusion and Exclusion Criteria

When a spine surgeon is considering cervical arthroplasty, they must determine if the procedure is right for each patient. They do this by considering the inclusion criteria used in the FDA clinical trials for each device. These criteria include:

- Musculoskeletal adult older than age 18
- Symptomatic cervical disc disease at one or two levels
- No previous anterior cervical spine surgery at the intended levels

Exclusion criteria include:

- Severe osteoporosis or other bone diseases.
- Active infection or systemic disease.
- Multilevel cervical disc disease beyond two levels.

Off-Label Uses and Hybrid Constructs

While cervical arthroplasty is primarily approved for one or two levels, there are instances where off label use or other hybrid constructs may be considered. Off-label use involves using the artificial disc in ways not specifically approved by the FDA, such as in patients with more than two affected cervical disc levels. Hybrid constructs combine cervical arthroplasty with ACDF, providing stability and motion preservation specifically targeted at different segments of the cervical spine to optimize motion, stability, and spinal alignment. Spine surgeons who are experts in CDR have experience in off-label uses.

Conclusion

Cervical arthroplasty offers a promising alternative to traditional fusion surgeries for patients with cervical disc disease. By preserving motion and potentially reducing the risk of adjacent segment degeneration, CDR can provide significant relief and improve quality of life for many patients. A thorough evaluation by a spine specialist trained in CDR is crucial to determine candidacy and ensure the best possible outcomes from this advanced surgical technique. As technology and surgical techniques continue to evolve, cervical arthroplasty may become an increasingly preferred option for treating degenerative disc based cervical spine disorders.

A COMPREHENSIVE OVERVIEW

Lumbar Arthroplasty Explained

Matthew Gornet, MD
The Orthopedic Center of St. Louis

Lumbar disc arthroplasty (LDA), also known as total disc replacement surgery, is a modern approach approved by the Food and Drug Administration (FDA) to safely and effectively treat severe and prolonged disc-related back pain while preserving spinal motion and function. This procedure involves replacing a damaged or degenerated intervertebral disc with an artificial disc implant, offering an alternative to traditional spinal fusion surgery, which aims to completely immobilize one or more unstable and painful vertebral levels.

When to Consider Surgery

Chronic discogenic pain results when one or more spinal discs are compromised by aging, wear, or injury to the cushioning disc between the vertebrae. To accurately diagnose the cause of pain, a physician will perform a thorough physical exam, and will likely order imaging studies including x-ray, MRI and/or CT of the lower spine to look for anomalies in the anatomy. Other diagnostic studies such as CT Discography may also be indicated. Lumbar disc arthroplasty is typically considered when nonoperative treatments such as physical therapy, chiropractic care, exercise programs, medications, and injections have failed to provide sufficient relief. Candidates for LDA generally meet specific criteria:

1 **Disc Degeneration:** Patients experience severe disc degeneration leading to chronic low back pain and/or leg pain (radiculopathy).

2 **Stability:** Candidates should not have significant spinal instability that may be better addressed by fusion surgery.

3 **Overall Health:** Patients should be in good general health without medical conditions that could increase surgical risks.

4 **Failed Conservative Treatments:** Symptoms persist despite attempting conservative therapies for an adequate duration (often around 6 months).

5 **Single or Two-Level Disease:** LDA is typically recommended for patients with one or two-level disc disease.

Surgical Approach

Lumbar disc arthroplasty aims to alleviate pain, restore disc height, decompress nerves, and maintain spinal mobility. The surgery is performed using an anterior approach:

- Anterior Approach: This method involves accessing the lumbar spine through the abdomen. A lower abdominal incision allows the surgeon to move aside abdominal muscles and organs to reach the spine from the front. This approach offers direct access to the disc space, facilitating removal of the damaged disc and precise placement of the artificial disc implant without disrupting the spinal muscles.

Lumbar disc arthroplasty represents a significant advancement in treating disc-related low back pain while restoring and preserving normal spinal biomechanics.

Types of Implants

Two types of artificial disc implants are FDA-approved and available in the United States, each designed with unique materials and mechanisms, including:

1. **Prodisc L:** A metal-on-plastic design, the prodisc L implant consists of metal endplates with a polyethylene core, allowing controlled motion at the treated level. This artificial disc is FDA-approved for one or two-level surgery.

2. **ActivL:** The activL disc features a metal endplate with a high-density polyethylene inlay. This design aims to provide stability while facilitating natural spinal movement, and is FDA-approved for single-level use.

Hybrid Approaches

In complex cases involving multiple damaged discs, surgeons may consider hybrid approaches combining lumbar disc arthroplasty with fusion techniques. These hybrids address issues such as adjacent segment disease or multiple-level degeneration, aiming to optimize both motion preservation and spinal stability. The decision for a hybrid approach depends on thorough evaluation by the surgical team, considering the patient's unique circumstances and surgical goals.

Off-label Use

Although primarily indicated for single or two-level disc disease, off-label uses of LDA have been explored:

1. **Adjacent Segment Disease:** Some surgeons consider LDA for patients with adjacent segment disease, where discs adjacent to a previous fusion show degeneration and symptomatic pain.

2. **Multilevel Disease:** While less common, LDA has been effectively used in selected cases involving more than two levels of disc degeneration.

3. **Hybrid Surgery:** Described above, also represents off-label usage of artificial discs.

4. **Individual Considerations:** Off-label uses require careful assessment of the patient's anatomy, symptoms, and overall health to weigh potential benefits against risks.

Conclusion

Lumbar disc arthroplasty represents a significant advancement in treating disc-related low back pain while restoring and preserving normal spinal biomechanics. Patients considering this procedure should consult with a qualified spine surgeon to discuss their individual case, addressing potential risks, benefits, and expected outcomes based on current evidence and best practices in spine medicine.

MOVING FORWARD:

Why Motion-Sparing Spine Surgery Is a Game Changer

Todd Lanman, MD
ADR Spinal Restoration Center

Motion-Preserving Surgery

Did you know that at one time, chronic hip or knee pain was treated with joint fusion? Orthopedic surgeons would fuse the knee or hip joints together. While the fusion surgery relieved pain, it also meant a life without movement of that joint. Today, surgeons replace the knee or the hip with an artificial joint, which everyone agrees is a much better choice.

We now can do the same for spinal bones (vertebrae). The vertebral segments are separated by discs which allow for movement of the spine along with smaller joints, called facet joints. Instead of fusing the bones together and permanently eliminating motion, spine surgeons can perform artificial disc replacement, which relieves pain and preserves spinal motion.

Fusion vs. Motion Preservation

Traditional spinal fusion surgery involves permanently joining two or more vertebrae to stabilize the spine. While this reduces pain, fusion can limit flexibility and potentially lead to additional stress on adjacent discs above and below the fused bones. In contrast, motion-preserving spine surgery such as artificial disc replacement, dynamic stabilization, and facet replacement reduce pain as well as (or better) than spinal fusion, but provide the impressive benefit of maintaining a more natural structure and movement of the spine. This reduces the chances for further surgery at adjacent discs.

Key Benefits of Motion Preservation

Pain Relief and Improved Spine Mobility

A spine surgeon recommends spinal fusion or artificial disc replacement when a diseased spinal disc is causing pain and other symptoms. The spine surgeon is going to remove the problematic disc in both cases, which usually relieves these symptoms. The main difference between the two procedures is what is done with the space that remains once the damaged disc is removed. In spinal fusion, bone matrix is placed in the space in the hopes that the two bones will fuse into one large bone. In artificial disc replacement, on the other hand, a device that has been designed to mimic the natural disc is inserted into the space, providing height, stability, and range of motion. Patients who undergo motion-preserving surgery, such as artificial disc replacement, often experience better overall mobility and flexibility. This preserved range of motion means participating in daily activities, work, and sport in ways that had not been possible with chronic neck or low back pain.

Patients who undergo motion-preserving surgery, such as artificial disc replacement, often experience better overall mobility and flexibility.

Faster Recovery and Rehabilitation

Motion-preserving techniques often result in shorter hospital stays and quicker returns to daily activities compared to traditional fusion surgeries. It can take several months for the fused space between spinal bones to fully heal, whereas an artificial disc integrates into the space in a fraction of the time. This faster recovery time can significantly improve the patient's overall experience and quality of life during the healing process.

Reduced Stress on Adjacent Segments

Motion-preserving technologies are designed to mimic the spine's natural structure and motion. Instead of locking the bones in place and creating highly unusual forces on the spine, an artificial disc distributes forces more evenly and naturally. Indeed, one of the biggest advantages of motion-preserving techniques is a decreased risk of adjacent segment degeneration. In fusion surgeries, the immobilized vertebrae can place additional stress on neighboring segments, potentially leading to accelerated wear and tear. Motion preservation helps distribute forces more evenly along the spine, reducing the likelihood of future problems in adjacent areas.

Lower Risk of Additional Surgeries

Unlike other orthopedic joints, the spine is unique in that all the levels of the spine (each motion segment) are stacked one on top of the other and are affected by the other segments, especially adjacent segments (the levels directly above or below). By preserving natural spine movement and reducing stress on adjacent segments, motion-preserving surgeries may decrease the need for future interventions. Data shows that fusion patients are 2.9 times more likely to need additional surgery at adjacent discs. Using the motion-preserving alternative, patients may be able to avoid revision surgeries, which will reduce long-term healthcare costs and provide far better outcomes for patients.

Multiple Level Artificial Disc Replacement

One place in which motion-preserving therapies really shine is when they are used to treat diseased discs at several levels of the spine. For example, a multi-level artificial disc replacement surgery involves implanting more than one artificial disc in the spine. Consider someone who has severe degenerative disc disease at multiple levels in their cervical spine (neck). They have severe neck pain, shoulder pain, and numbness and tingling down one arm with a weak hand. Life is miserable and conservative treatments did very little to help the situation.

If the person in this scenario is treated with a multi-level spinal fusion, it will likely relieve the pain and other symptoms, but will significantly limit bending, extending, and twisting the neck. If everything heals according to plan, the spinal bones in the neck will be fused solid. As an alternative option, a multi-level artificial disc replacement surgery will also relieve the pain and other symptoms, but the spinal bones in the neck will continue to move relative to one another. This not only results in the preservation of neck motion, but often also restores motion that had been lost by the damaged discs.

Considerations and Patient Selection

While motion-preserving spine surgery offers numerous benefits, it is not suitable for everyone. People with osteoporosis, severe facet joint disease, spinal deformities, cancer, or certain chronic illnesses may not be eligible. However, we have learned over the past decade that some people who we once thought would not be ideal candidates for motion-preserving treatments like artificial disc replacement actually do extremely well. Therefore, patients need to consult with a spine surgeon who has extensive experience with both spinal fusion and artificial disc replacement and other motion-preserving techniques. This will ensure that the patient is offered the best solution for their unique pathology.

NATIONAL SPINE HEALTH FOUNDATION

Section 3

21. BREAKING THROUGH BARRIERS: OVERCOMING INSURANCE CHALLENGES FOR DISC REPLACEMENT

24. FROM RIGID TO RESILIENT: THE EVOLUTION OF MOTION-PRESERVING SPINE PROCEDURES

26. DISC ARTHROPLASTY 101: ANSWERS TO YOUR MOST FREQUENTLY ASKED QUESTIONS

BREAKING THROUGH BARRIERS:

Overcoming Insurance Challenges for Disc Replacement

Jack Zigler, MD
Texas Back Institute

Kimberly Norton
Texas Back Institute

Background

Despite the Food and Drug Administration (FDA) approval of **artificial discs**, most patients did not have access to the treatment option known as arthroplasty (or disc replacement surgery) until insurance companies provided authorization of the procedure and covered the cost. It has been a long journey for arthroplasty reimbursement, and more is left to achieve.

Healthcare coverage in the United States is a complex topic. This article will focus on two types of insurers. The first is Medicare, which is a federal health insurance mainly for people 65 years or older. The second is the broad category of private health insurance, which is most often provided as an employment benefit and is offered by a variety of companies (Aetna, Cigna, etc.) with a variety of plans (HMO, PPO, POS). Coverage varies based on these plans, and Medicare often sets the precedent for what the private insurers cover.

In general, the path to bringing a new device (in this case, artificial disc) from a patent to the patient is:

1 **Research and development:** The device is designed based on prototyping.

2 **Regulatory approval:** The FDA requires approval of new devices, such as artificial discs, based on clinical trial results.

3 **Clinical trials:** Rigorous clinical trials must demonstrate safety & efficacy to gain FDA approval.

4 **Manufacturing:** Device manufacturers begin production.

5 **Market approval:** Once regulatory approval is obtained, the device can be marketed to healthcare providers & facilities.

6 **Training:** Healthcare professionals are trained to use the device safely.

7 **Insurance coverage:** Manufacturers & healthcare providers work with insurance companies to develop reimbursement strategies, which includes coding & billing.

8 **Patient access:** Organizations like the National Spine Health Foundation educate patients on treatment options & spine surgeons discuss new treatment options with patients who qualify.

9 **Monitoring:** Manufacturers & healthcare providers monitor performance and safety in real-world settings.

It is important to note that several artificial disc implants have gone through that lengthy process, separately for **cervical (neck)** and **lumbar (low back)** implants, for the treatment of 1- and 2-levels of disc disease, and were granted FDA approval.

Approval Limitations

Going back to the clinical trials, it must be highlighted that the conditions under which the artificial discs are tested are very strict, giving clear results, which helps with the FDA approval process. FDA approval is based on these specific conditions, but this does not mean that those strict conditions are the only conditions under which the device will work. In the case of artificial discs, there are many uses that extend beyond what was tested in the clinical trials, and it is up to the expertise of the spine surgeon to make treatment recommendations based on each patient's pathology. However, insurance coverage will vary for these "off label" uses.

For example, hybrid surgery in the neck combines implanting an artificial disc at one cervical disc level and a fusion at another level. Hybrid surgeries were not studied in the original FDA clinical trials, and thus are not included in the specific FDA labeling or in the insurance coverage of most plans. There have been many non-FDA studies demonstrating the benefits of hybrid surgery, yet there are only 2-3 private insurers that cover hybrid surgery in the neck.

Hard-Fought Battles

Lumbar arthroplasty coverage has been an unusually hard-fought battle to get to the point where 90% of private insurers cover 1-level surgery and about 40% cover 2-level surgery today. The history of this challenge started in the early 2000's with skeptics requesting that Medicare conduct a national analysis of the first lumbar artificial disc. They did this knowing that the clinical trial was limited to patients 18-60 years old, which is below the typical Medicare-aged population of 65 years. Without data to prove clinical efficacy for this age group, Medicare issued a national non-coverage determination blocking coverage for their insured. In addition, this determination by Medicare led private insurers to quickly follow suit, essentially closing the door on general coverage for all age groups of this modern technology.

Over time, industry leaders, dedicated spine surgeons, and many patients have fought insurance denials by peer-to-peer conversations with insurers, working through the external appeals process, and ultimately by class action lawsuits against insurers for denying access to care. Slowly coverage has opened but remains limited to the literal interpretation of the strict criteria included in the original clinical trials.

Understanding the Evidence

Clinical experience with cervical and lumbar arthroplasty has been overwhelmingly positive:

- Most patients with follow-ups of 15-25 years have not required any significant long-term interventions for device failure or symptomatic adjacent level disease (issues at neighboring discs).
- Many long-term studies have demonstrated that patients who received artificial discs had similar or improved outcomes and a **significant decrease in additional surgery** compared to patients randomly assigned to receive the fusion alternative.
- Consistent data at 5-years show that cervical arthroplasty patients had **3-5 times LESS reoperations** than matched fusion patients, and lumbar arthroplasty patients have **only one-third of worsening adjacent levels** as fusion patients.
- A 5-year meta-analysis of four multicenter studies showed superiority in patient-reported disability improvement, reoperation rate, pain relief, and patient satisfaction of arthroplasty over fusion.

It has been a long journey for arthroplasty reimbursement, and more is left to achieve.

- Several health economics papers have demonstrated **reduced costs** to the insurance carrier for cervical arthroplasty than for cervical fusion (ACDF). In the lumbar spine, implant costs per segment are less with lumbar arthroplasty than with any fusion surgery, which may include implants, bone graft, and more.

Unfortunately, although annual reviews of insurance company medical policies are supposed to be based on objective analysis of published data, they do not routinely result in a change to their coverage policies, even though both cervical and lumbar arthroplasty have been more intensively studied than any other implant used in the human body.

What Can Be Done?

Arthroplasty surgeons spend quite a bit of time on the phone with the insurance companies of their patients who are being denied access to arthroplasty. These "peer-to-peer" calls are used to justify denials and are generally not a discussion between a surgeon and an informed peer, but may result in an invitation to request another level of review. "Additional review" notifications on the eve of a previously approved and scheduled surgery are also occurring with more regularity, as well as denials of payment for previously-approved surgical procedures.

The clinician's best weapon is self-education regarding the strong published literature, including real-world evidence of expanded use based on decades of clinical experience beyond the strict FDA indications and exclusions. This information should be discussed with the insurance company's additional **Peer Reviewer** who will hopefully be a reasonable clinician willing to grant an exception to the initial denial based on a more in-depth clinical discussion.

Going forward, **Big Data** should ultimately come to the attention of insurers, who will recognize the lower complication and reoperation rates with arthroplasty (the major drivers of postoperative health care costs) and then soften authorization criteria. Auditing these complication and reoperation rates will potentially identify surgeons who should be **preferred providers** for this technology, a model that has worked well with procedures such as cardiac surgery and joint replacements, like hips and knees.

Surgeons need to demand that their **professional organizations** (ISASS, AANS, AAOS) remain actively involved in the fight. This will help to ensure that patients have access to care utilizing appropriate FDA-approved technologies deemed best for a specific patient's medical condition by a trained and qualified spine specialist. The ***National Spine Health Foundation*** represents the patient voice and is the only patient advocacy organization working with professional societies to improve access to care by creating materials such as this journal.

The science is there. The clinical experience is there. The coverage is improving for arthroplasty, but the devil is in the details. Public education and **patient demand** will ultimately tip the scale towards an easier path to more universal patient access to this motion-preserving technology.

FROM RIGID TO RESILIENT:

The Evolution of Motion-Preserving Spine Procedures

Frank Phillips, MD
Midwest Orthopaedics at Rush

Alexander Butler, MD
Lenox Hill Hospital – Northwell Health

In recent years, the field of spine surgery has borne witness to a variety of new techniques and technologies aimed at effectively treating spinal pathology without requiring fusion. The concept of motion-preserving spine surgery has gained popularity as an avenue for minimizing the potential downsides of spinal fusion, such as loss of range of motion or progression of degeneration of other spinal segments that have not been fused. Having evolved for several decades, artificial discs for cervical and lumbar disc replacement have arguably become standard of care for certain neck and low back conditions. The design of these implants continues to progress to allow for improved mechanics and durability. Emerging alternative options for motion-sparing spinal surgery in the lumbar spine include TOPS, MOTUS, and PerQdisc. Additionally, cutting edge research in the field of disc regeneration is ongoing, which has potential treatment applications for both cervical and lumbar conditions. This article will explore these technologies.

Disc Designs

The discs are located in the anterior (front) of the spine. There are a few factors that must be considered with regards to the design of artificial discs used for cervical and lumbar disc replacement: motion, durability, and implantation. Artificial discs on the market vary in design, in effort to optimize these three elements.

Artificial discs aim to allow motion similar to the native disc's natural motion at the treated spinal segment. Most devices consist of separate pieces including a metal baseplate and plastic polymer that allow for a constrained gliding motion.[1] As we learn from the field of hip and knee replacement, the long-term wear on these materials may influence the long-term motion of the device or require revision surgery.[3] Optimizing the durability of materials used is an ongoing pursuit, and forthcoming long-term studies will help in understanding the impact of this on patient outcomes.

In addition to biomaterials, artificial discs vary in the way they are surgically implanted and subsequently interact with the vertebra. Some devices employ a keel which requires a cut in the bone to allow for mechanical fit while others utilize specific finishes on the metal baseplate to encourage on-growth of bone after implantation. Future artificial discs will need to ensure rapid and reliable stability between the vertebrae of the treated level, while minimizing the impact of the surgical procedure or to surrounding structures.

Facet Joint Replacement

Facet joints are small joints in the posterior (back) of the spine that allow for motion of a spinal segment together with the disc in the anterior (front) of the spine. In patients for whom a posterior (back) surgery is indicated, such as a lumbar decompression to address neural compression, and fusion, several alternatives have been recently developed to allow for motion of the facet joints.

The TOPS System (Premia Spine, Ltd.) uses pedicle screw fixation, similar to those used in most lumbar fusions. In fusion procedures, the pedicle screws are then attached to rigid rods that stop the motion at that level. Conversely, with the TOPS procedure, the pedicle screws are attached to an articulating metal and plastic polymer component designed to mimic the function of native lumbar facet joints by maintaining motion. In 2023, the TOPS System received FDA approval for treatment of grade I lumbar spondylolisthesis from L2-L5.[3]

The MOTUS investigational device (3Spine, Inc.) is designed to serve as a replacement for the entire motion segment. As with TOPS, this is implanted after a thorough posterior decompression. Two devices are then fixed to both vertebrae of the treated level with components in both the disc and facet joints of the spine. This aims to preserve the height of the removed disc and to facilitate motion. Still in the early phases of testing, an IDE clinical trial for FDA approval is currently ongoing.[4]

Lumbar Disc Nucleus Replacement

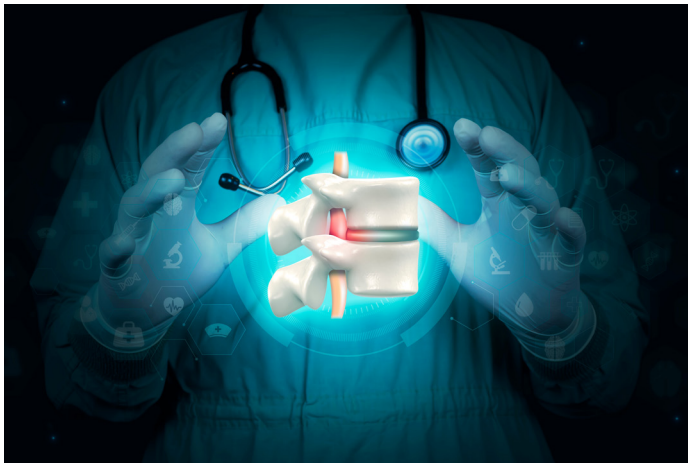
There are two main parts of a spinal disc, the nucleus (center) and the annulus (outer ring). Artificial discs replace the entire disc (nucleus and annulus), known as a total disc replacement. For treatment of low back pain due to degenerative disc disease, a novel implantable device, called PerQdisc (Spinal Stabilization Technologies, LLC), offers a fluid-filled chamber that replaces the nucleus of a lumbar disc, but keeps the native annulus intact. This is designed to distribute forces on the spinal segment and maintain or restore motion. Implanted through an anterior or lateral approach to the spine through the flank, this technology is actively being investigated in multiple clinical trials.

Disc Regeneration

Looking further down the line, the science of influencing, maintaining, and even re-building cervical and lumbar disc material and function is an immensely exciting field. A collection of biologic and chemical therapies including exosomes, stem cells, and structural scaffolds offer promise regarding the potential to regrow injured or degenerated discs and avoid the need for future invasive surgery. Clinical scientists have recently published the results of an animal study using a repair patch for herniated discs which incorporates mechanically-activated microcapsules for delivery of biologic agents to influence the healing process; we look forward to human application research in the coming years.[5]

Conclusion

Spinal motion preservation is a rapidly evolving concept in spinal healthcare. Much research is being done in this field to create the best options for patients with symptomatic disc disease. This is promising to the vast number of those affected by spinal conditions. The National Spine Health Foundation is dedicated to bringing the most up-to-date information to the spinal community.



[1] Patwardhan AG, Havey RM. Biomechanics of Cervical Disc Arthroplasty-A Review of Concepts and Current Technology. Int J Spine Surg. 2020 Aug;14(s2):S14-S28. doi: 10.14444/7087. PMID: 32994302; PMCID: PMC7528772.

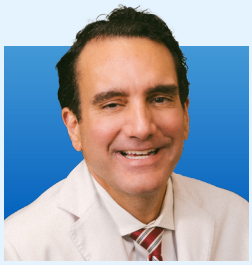
[2] Zavras AG, Dandu N, Nolte MT, Butler AJ, Federico VP, Sayari AJ, Sullivan TB, Colman MW. Segmental range of motion after cervical total disc arthroplasty at long-term follow-up: a systematic review and meta-analysis. J Neurosurg Spine. 2022 Apr 22;37(4):579-587. PMID: 35453108.

[3] Pinter ZW, Freedman BA, Nassr A, Sebastian AS, Coric D, Welch WC, Steinmetz MP, Robbins SE, Ament J, Anand N, Arnold P, Baron E, Huang J, Whitmore R, Whiting D, Tahernia D, Sandhu F, Chahlavi A, Cheng J, Chi J, Pirris S, Groff M, Fabi A, Meyer S, Kushwaha V, Kent R, DeLuca S, Smorgick Y, Anekstein Y; TOPS Study Group. A Prospective Study of Lumbar Facet Arthroplasty in the Treatment of Degenerative Spondylolisthesis and Stenosis: Results from the Total Posterior Spine System (TOPS) IDE Study. Clin Spine Surg. 2023 Mar 1;36(2):E59-E69. PMID: 36191093

[4] Alex Sielatycki J, Devin CJ, Pennings J, Koscielski M, Metcalf T, Archer KR, Dunn R, Craig Humphreys S, Hodges S. A novel lumbar total joint replacement may be an improvement over fusion for degenerative lumbar conditions: a comparative analysis of patient-reported outcomes at one year. Spine J. 2021 May;21(5):829-840. doi: 10.1016/j.spinee.2020.12.001. Epub 2020 Dec 17. PMID: 33346156.

[5] Peredo AP, Gullbrand SE, Friday CS, Orozco BS, Dehghani B, Jenk AC, Bonnevie ED, Hilliard RL, Zlotnick HM, Dodge GR, Lee D, Engiles JB, Hast MW, Schaer TP, Smith HE, Mauck RL. Tension-activated nanofiber patches delivering an anti-inflammatory drug improve repair in a goat intervertebral disc herniation model. Sci Transl Med. 2023 Nov 15;15(722):eadf1690. doi: 10.1126/scitranslmed.adf1690. Epub 2023 Nov 15. PMID: 37967202; PMCID: PMC10812087.

Arthroplasty 101: Answers to Your Most Frequently Asked Questions



Najeeb Thomas, MD
Southern Brain and Spine

1 What is disc arthroplasty surgery and is it different from disc replacement surgery?

Disc arthroplasty surgery is a surgical procedure whereby a person's own disc is removed and replaced with a mechanical device, called an artificial disc. Disc arthroplasty is another name for disc replacement surgery.

2 Is disc arthroplasty surgery experimental?

Disc arthroplasty surgery is not experimental. Artificial discs were first introduced in the United States in March of 2000. Since that time, there have been many of these devices designed by multiple manufacturers and approved by the Food and Drug Administration (FDA).

3 What are the discs replaced with during surgery?

The natural disc is made of tissue similar to cartilage, which can become damaged over time. The damaged disc is replaced with an artificial disc made with a variety of polymers (i.e. plastics) and alloys (i.e. metals). Some artificial discs are designed with all metal components, some are designed with a combination of metal and medical grade plastic components, and all are designed to maintain motion.

4 Who is a candidate for disc arthroplasty?

Many patients are candidates for artificial disc replacement (disc arthroplasty). If a damaged disc is causing significant pain and limitation that does not improve with nonoperative treatments, then disc arthroplasty should be considered. The spine surgeon will determine on a case-by-case basis if each patient is a candidate for this surgery or not, which is based on several factors.

5 Is disc arthroplasty successful?

Disc arthroplasty is very successful in alleviating symptoms associated with painful degenerative discs, disc herniations, and compression of the spinal cord or nerves. This procedure has been intensely researched to track outcomes since the beginning of their use and continues to show impressive results.

6 How long does it take to recover from surgery?

Recovery time from this type of surgery is less than the traditional fusion surgery. In a traditional fusion, the bones take months to heal and eliminate motion. During healing, activities are restricted. In disc replacement surgery, motion is maintained so the restrictions during healing are much less. Symptoms typically improve within a week or so and light activities can gradually resume. Expect

several weeks of healing, ranging from 3-12 weeks depending on the region of the spine and how many discs were involved in surgery. Disc replacement surgery can be done as same day surgery or outpatient surgery in the hospital or as an ambulatory procedure in an ambulatory surgery center (ASC).

7 What are the benefits of disc arthroplasty surgery?

The benefits of disc arthroplasty surgery include faster recovery time, preservation of motion, and less biomechanical stress on the other discs in the spine. When motion is maintained, restored, or improved at the surgical disc level(s), then the other remaining discs can function normally (without extra stress) and should not rapidly deteriorate as was seen with traditional fusion surgery.

8 What are the risks of disc arthroplasty surgery?

All surgeries have some risks. The risks associated with disc arthroplasty are very similar to traditional fusion surgery which include continued pain, trouble swallowing, nerve injury, blood vessel injury, device issues, infection, and the risks of general anesthesia.

9 Do all spine surgeons perform this surgery?

Not all spine surgeons performed this type of surgery. Disc arthroplasty has gained popularity among patients and surgeons as long-term data has been released. It is important to ask your spine surgeon if they perform disc replacement surgery so that you can be sure this procedure was considered in your treatment options.

10 Does insurance cover this surgery?

Once FDA approval is gained, insurance coverage is the next hurdle to bringing new treatments to patients. After many years of work, health insurance coverage for disc arthroplasty is improving. Specific plans, network contracting, and deductibles play a large role in out-of-pocket costs to patients for disc arthroplasty. Surgeons who are skilled to perform this surgery are also skilled at navigating insurance challenges that exist. Currently, the majority of insurance plans cover disc arthroplasty surgery.

NATIONAL SPINE HEALTH FOUNDATION

Section 4

29. PATIENT STORY: JENNA BENDINELLI

PATIENT STORY

Jenna Bendinelli's Journey to Recovery

My back journey began when I was in college. I was in great shape as a collegiate field hockey player, but developed severe low back pain that put me on the sidelines until I recovered. I was diagnosed with a torn disc at L5-S1 (the lowest level of the low back region). Through a combination of nonoperative treatments, I achieved pain relief, returned to my sport, and graduated college. These treatments included physical therapy, a series of injections, and a nerve ablation.

In November of 2021, I developed pressure and a deep ache in my lower back, which I immediately recognized as the pain from my L5-S1 disc tear 5 years prior. My active lifestyle quickly changed, and I could no longer run, lift, hike, ski or play golf with my dad. The pain made it increasingly difficult to do my job, coach field hockey, and work towards my master's degree. It was time to seek formal treatment again.

I returned to the pain management doctor that previously helped get back to field hockey. An MRI showed the previously torn L5-S1 disc was now coupled with significant degeneration. We repeated the previous nonoperative approach to treatments, including SI and facet joint injections, nerve ablation, and an epidural. This time around, every single intervention failed to provide any relief.

With each failed procedure I was losing hope of finding relief and got increasingly frustrated. In the summer of 2022, I exhausted nonoperative options and I was still having constant pain while sitting, standing, and moving. I stopped working out and my mental health was impacted. I was halfway through working towards a master's degree and was struggling to focus on lectures, and I also needed frequent

Both surgeons favored disc replacement due to its ability to preserve motion and flexibility in the spine which would allow me to return to an active lifestyle.

breaks at work. My pain management doctor was perplexed that nothing seemed to work and recommended that I see a spine surgeon. My friends and family saw the limitations my back was putting on my life and helped me to take this step. I was apprehensive about needing surgery at such a young age, but was excited that there was still hope of alleviating my pain.

When the spine surgeon saw the list of failed procedures, he ordered more diagnostic tests. I had a bone scan and discogram that confirmed undeniably that the L5-S1 disc was the source of my pain. I was then presented with two surgical options, lumbar fusion or disc replacement. At this point, I obtained a second opinion. The second spine surgeon verified that we exhausted all nonsurgical treatment options and gave me confidence when he recommended the same surgical options. Both surgeons favored disc replacement due to its ability to preserve motion and flexibility in the spine which would allow me to return to an active lifestyle.

It was now the summer of 2023, and I had received my master's degree and was ready to get my health back. I did some research and was encouraged by the personal stories I read and the statistics on returning to sports after surgery. I decided to proceed with the disc replacement surgery. I was hopeful that this would finally let me get back to my favorite activities, but I was also scared because this felt like my final solution, and I needed it to be a success.

At just 26 years old, I underwent spine surgery. A few hours after the procedure I started getting up and moving with a walker. After three nights in the hospital, I was able to go home. For the first six weeks I was restricted. During this period of early recovery, there were ups and downs. Every day wasn't a success, but my friends and family kept reminding me of the weekly progress I was making which helped me stay optimistic and determined. At six weeks, I could bend and twist 50%, and I started two months of physical therapy to build core strength. I was worried by my pain, but my body simply needed more time to heal. Around eleven weeks, I noticed significant improvement, but then experienced a setback when I developed pain in my SI joint. This was eased with a steroid injection so I could continue my progression.

I was cleared of all restrictions by six months after surgery, and was able to return to all my activities since that time. Trying each activity for the first time brought me immense joy. Now in 2024, when I try new movements, I must be patient to give my back time to adjust. I still manage SI pain when traveling. Yet, these are very minor issues compared to before surgery. I have finally been able to enjoy walks and make it through the workday without back pain. I have been able to snorkel, hike, ski, golf, paddle board, play pickleball, and actively coach field hockey again. My disc replacement gave me my life back!

The Research Institute at National Spine Health Foundation

From the Research Institute

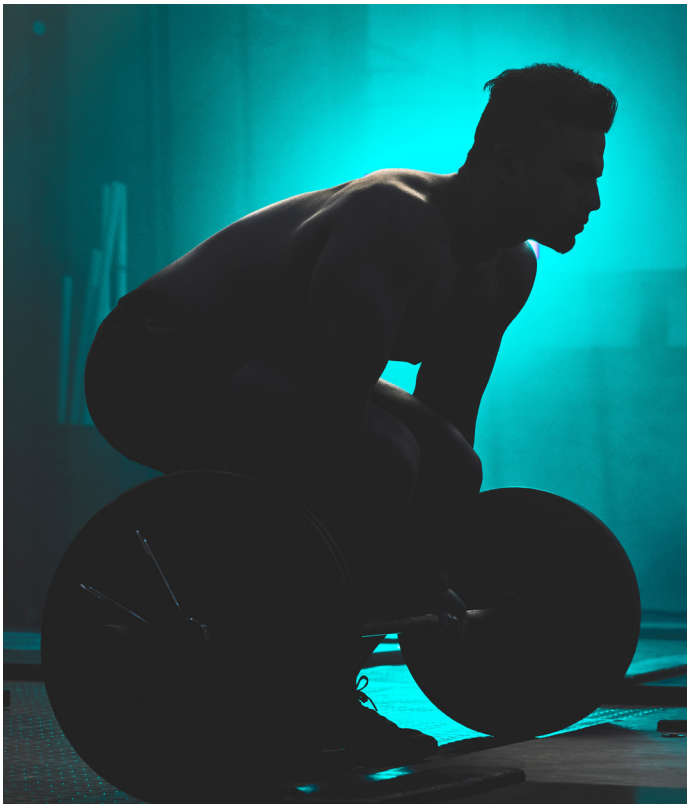
32. STRONG SPINE, STRONG FUTURE: HOW YOUNG ADULTS CAN PRESERVE SPINAL MOTION FOR LIFE

STRONG SPINE, STRONG FUTURE:

How Young Adults Can Preserve Spinal Motion for Life

Yusuf Rafiqzad, Curtis Weh, and Anika Morisetty
The Research Institute

Spine health is important for day-to-day activities, but also allows for more strenuous activities such as weightlifting and sports. This article explores the experiences of a **weightlifter**, a collegiate track **runner**, and a high school varsity **tennis player**. Each perspective emphasizes the significance of spinal motion with respect to their athletic endeavors, but also to their daily lives outside of sports.



The Weightlifter

As a weightlifter and current postgraduate researcher in the midst of applying to medical school, I have grown to understand the significance of spine health. Through my time in the weight room and working towards medical school, the connection between motion preservation and spine health has become quite evident. Even at a young age, this connection must not be overlooked.

My passion for weightlifting stems from my time as a football player when I was younger and has grown to be a large part of my life. Weightlifting serves as both an avenue for stress relief and contributes to my overall health and well-being. The spine is central to all core components of weightlifting. I have found that to be an efficient weightlifter and see results, spine health has to be prioritized, especially spine mobility. By understanding the importance of protecting spinal motion, I follow a pre-workout routine to help preserve motion and reinforce my health and fitness goals:

Stretching before every workout

I stretch before my workouts to help increase my flexibility and range of motion. By doing so, I am able to carry out each rep and set in my workout with proper form, which is important for both progress in the gym and avoiding injury.

Rolling out and dead-hangs

In addition to stretching, I also roll out my back using a foam roller, which helps greatly with myofascial release and relieving any tight points along my back before my workout begins. I also like to do a few seconds of dead hangs (hanging on a pull up bar) as I have found that it helps relieve pressure in my back, improve my posture, and engage my core.

Core engagement

The advantages of having a strong core and engaging it correctly while lifting heavy weights cannot be overstated. I recall an injury I sustained a few years ago lifting because I was squatting heavy without engaging my core enough, causing low back pain for the next few months. Having a strong core provides stability for the spine during dynamic movements, which is most of weightlifting, and helps minimize the risk of injury while lifting. It also supports the spine by distributing the load force, taking some pressure off the spine.

Together, these three motion-preserving practices have helped improve my results in the weight room and contribute to good practices in spinal health.

When I am not in the gym, I spend quite a bit of time working towards medical school and in my current work as a researcher. I am well acquainted with prolonged periods of sitting at a desk. Like so many with a desk job, I sometimes find myself slouching, especially when studying. Poor posture goes against the natural alignment of the spine. Prolonged poor posture can put us at risk for spinal degeneration later in life, injury, and loss of spinal motion. I catch myself hunched over in my chair or looking down in a stooped position as I study or work at my laptop.

Having proper posture helps maintain our bodies natural alignment and can reduce stress on the spine, ultimately reducing the risk of injury. It is important to minimize stress on the spine and limit any hindrance on spine mobility. I have learned that my present actions will affect my spinal future. In an effort to improve my sedentary situation, I like to utilize a pillow, take incremental walking/stretching breaks, and keep my feet grounded. These small adjustments have helped me improve my posture and practice better spine health.

The Runner

As a collegiate track runner, I've spent countless hours honing my craft, pushing my body to its limits, and attempting to master the art of motion. From grueling reps of 300 meters uphill to full body Olympic lifts, motion has been important to every inch of progression in my life. Understanding the anatomy and mechanics of track running has been crucial in my development on the track and in the classroom.

THE SPINE HEALTH JOURNAL

Track and field is a complex interplay of various anatomical structures working in harmony. The primary muscles involved in running are the quadriceps, hamstrings, gluteus maximus, calf muscles, and the core muscles. The **quadriceps**, located at the front of the thigh, are responsible for extending the knee and propelling the body forward. The **hamstrings**, at the back of the thigh, play a significant role in knee flexion and hip extension. The **gluteus maximus**, the largest muscle in the body, is vital for hip extension and stabilizing the pelvis. The **calf muscles**, specifically the gastrocnemius and soleus, are essential for allowing the foot to push off the ground. Lastly, the **core muscles** provide stability and balance, ensuring efficient and safe movement.

The core is often thought of as being just the abdominal muscles, “the abs,” in only the front of the midsection. But think of the core of an apple. No matter what direction you rotate the apple, the core remains at the center achieving inner stability from all angles. The core of the human body is similar, and includes the abdominal muscles in the front (rectus abdominis is more superficial and transverse abdominis is deep), the strong muscles of the back (called multifidus), and the oblique muscles on the sides. The diaphragm above and pelvic floor below are also often considered part of the core. Among numerous other activities, the core supports and protects spinal motion.

As a student-athlete, balancing rigorous training sessions with demanding academic coursework has taught me invaluable lessons of remaining mobile throughout the course of my day and working on flexibility. As someone with long legs, my leg muscles are often tight following an arduous workout. Tight leg muscles can decisively affect the spine by altering posture and everyday movement. Tight hamstrings can pull the pelvis into a posterior tilt, increasing stress on the lower back. In contrast, tight quadriceps can cause an anterior pelvic tilt, straining the lumbar spine and contributing to lower back pain.

Imbalances can lead to discomfort, reduced range of motion, and increased risk of injury due to the altered mechanics and added stress on the spine. Remaining in motion as the day progresses, counters stiff joints and tight muscles. I stay in motion by doing yoga after every training session and in the morning, walking to class, and locating standing desks on campus for studying. Yoga encourages blood flow to the muscle fibers, which can add to the benefit of a workout. Stretching can lower and even prevent the risk of injury.

By embracing these practices, I’m enhancing my athletic and academic performance, safeguarding my spinal health, and preparing for the challenges ahead as I pursue a career as an orthopedic spine surgeon. Surgery demands precision, endurance, and physical resilience, so ensuring that I am fit to meet these demands is one of the many imperative steps to having success in this field. The insights gained from my athletic endeavors, particularly in understanding the intricate relationship between leg muscles and spinal alignment, will be invaluable as I work diligently. Additionally, the ability to empathize with patients experiencing spinal issues due to muscular imbalances allows for greater interpersonal connections. By integrating preventive practices into my daily routine now, I am protecting spinal motion and laying the foundation for a long and sustainable career.

The Tennis Player

Imagine this: you go in for the big shot, feeling the rush of joy as your racket makes perfect contact with the ball. Suddenly, a sharp pain surges through your back. Your body can't sustain the demands of the hit, and the recoil leaves you struggling to move. It's a stark reminder of the toll that hours of sitting in class have taken on your spine.

As a high school student, I am stuck in the classroom for hours and am often hunched over desks and only have a few minutes to walk and stretch my legs between classes. This loss of activity takes a physical and mental toll on our bodies. This problem is real and draining. Speaking from my own experience this isn't something to ignore, whether you are a student athlete or not.

I'm on my high school's varsity tennis team, which is a sport that requires constant motion. During practice, we replicate the movements required to excel during a match, including **running**, **lunging**, and **twisting** in every direction. Whether sprinting to the net for a volley or twisting for a perfect backhand, every part of my body is moving. The sport is multi-directional and multi-planar, requiring quick transitions between forward and backward, side-to-side, and rotational movements. In a typical match, my body rotates to hit ground shots, moves laterally and lunges to chase down shots, and sprints forward to volley. These diverse movements and shots activate different muscle groups, keeping my spine flexible and robust.

The serve in tennis is a perfect instance of the physical demands of the sport. It's not just about hitting the ball; it's about the whole body working together. The spine hyperextends in the backswing and rotates through the follow-up. The greatest stress manifests after the ball is hit due to the extreme forces generated by the powerful serve. To protect myself from injuries, I need to be conscious of using my core muscles. Core strength is an essential part of keeping my spine healthy and in motion. On the tennis court, my body is engaged, and my spine is in constant motion. Off the court, I'm stuck in prolonged periods of no activity, which is less than ideal. The contrast couldn't be more stark.

During school, I spend most of my day hunched over sitting at a table or desk. We generally have 90-minute class periods with 5-7 minutes in between to get to the next class. There's barely any time to walk around and the only actual breaks are for lunch or a short bathroom trip. The result? I experience strain in my neck and my posture suffers. This setting also places loads of pressure on the lower back. Prolonged sitting, in particular with bad posture, can result in significant back problems. Unfortunately, schools are not designed with spinal health and motion in mind, and students are suffering as a result.

Take Home Message

Whether you are weightlifting, running, playing tennis, studying, working, or participating in daily activities, having a healthy and fluid spine allows for optimal results in the various activities we may face. By emphasizing the significance of protecting spinal motion, we hope the need to incorporate daily spine health practices is apparent. At a young age, or any age, recognizing the importance of spinal health can enhance performance in sports and daily activities, ensuring a foundation for lifelong wellness. Spine health and motion are important throughout every facet of life.

CHAIRMAN'S NOTE

Thomas C. Schuler, MD, FACS
The Virginia Spine Institute

"What would you do if this was you or your loved one?"

As a spine surgeon, this is the most common question I hear. I can answer that wholeheartedly because I have personal experience as a spine surgeon, a research investigator, and a spine patient. In 2013, I developed severe neck and arm symptoms after having intermittent milder symptoms for a few years. I started to notice increasing neurologic symptoms in my arm and knew this was a concerning problem. I was afraid to lose motor function and strength in my arm and hand. I couldn't ignore the symptoms any longer and knew it was time to begin formal treatments.

I tried medication, therapy, rest and even an injection without success. Hand dexterity and strength are essential to me as an expert spine surgeon, so I quickly knew that I had to follow the advice that I have given to many of my patients, which was to protect the nerve function with surgical correction of the problem. I needed relief from the nerve pressure caused by disc herniations and arthritis. I was fortunate that this occurred during the time technology was rapidly advancing in the field of spine surgery, such that I could improve my situation and restore my function back to the level it was before the entire process started. That great technology is called the artificial disc used in a procedure known as disc replacement surgery, also known as disc arthroplasty.

The discs and bones of the spine are stacked in an alternating fashion to make up the spinal column, providing structure and support to the body. Equally as important is the vast array of motions the discs allow for, including **flexion** (bending forward), **extension** (bending backward), **lateral** (side) **bending**, and **rotation** as well as compression and distraction. Traditionally, if somebody was not able to get better without surgery, the treatment was to fuse one bone to the next and stop the motion at that level. This succeeded in eliminating the symptoms, but placed more stress on the discs adjacent (next) to the fused bones. We are blessed to live in a time when technology has evolved, and today, we have great choices.

In 2013, my choice was to have a very innovative surgery for that time. I had three discs that required

Anterior cervical hybrid surgery with 2 artificial discs above 1 level of fusion.

treatment and one was so badly degenerative that we chose to fuse and stabilize it, but the two discs above had enough mobility that we were able to restore the height and balance with artificial discs. This combination of fusion and arthroplasty is called **hybrid surgery**. The artificial discs not only preserved my motion at those two levels, but astonishingly provided a better motion pattern than I had going into the surgery, much more consistent with that of my youth.

Motion is life. As treating physicians, our ability to preserve, restore, or improve motion is based on having access to technology such as artificial discs. We are now using this routinely in both the cervical (neck) and lumbar (low back) spine. The most important question to consider for every surgical patient is, ***"must the motion be eliminated with a fusion, or can we preserve motion with arthroplasty?"*** This advancement is going to lead to a paradigm shift in the treatment of the spine.

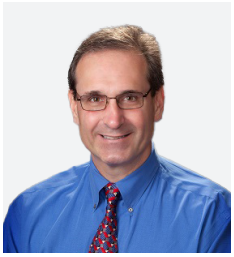
Life is a degenerative process. Discs break down over time (some worse than others) and the spine gets stiffer. With the development and use of artificial discs over a decade, we can produce a better result for our patients by treating symptomatic discs sooner rather than waiting until irreparable damage is done, and fusion is the only viable surgical option. Specifically, if we restore the height and balance to the disc and preserve motion with arthroplasty, we take stress off the adjacent levels of disc. Alternatively, if we wait until motion cannot be restored and fusion must be performed, then the adjacent levels are more likely to be overworked and have their own problems, often requiring additional surgical treatment to correct.

Landmark research done by the National Spine Health Foundation assessed differences in adjacent segment burden between all-fusion constructs and hybrid constructs (combination of arthroplasty and fusion) in the cervical (neck) spine, like I had. The study showed that discs above a motion-eliminating fusion developed extra motion, stress, and burden. Conversely, discs above a motion-preserving artificial disc returned to a more natural motion and were released from the burden already caused by the damaged discs before surgery. Meaning, discs are meant to share the motion load and limitations in disc motion (caused by degeneration, arthritis, or fusion surgery) overburden the remaining discs, highlighting the importance of motion-preservation for short-term and long-term outcomes.

I have seen these benefits directly through research, the outcomes of my patients, and my own recovery and return to life. I am now 11 years out from my surgery and happy to report that I am still functioning and doing all the things that I want to do including being an active surgeon, golfing, playing tennis, exercising, traveling and not being impaired. So, when patients ask me what I would do if this were me, I share my story. Motion is life and preserving motion is the best way forward today and in the future.

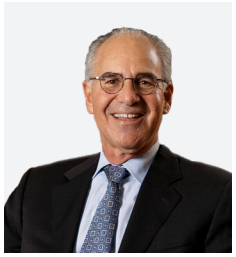
About Our Authors

About Our Authors



DR. DOMAGOJ CORIC practiced neurosurgery at Carolina Neurosurgery and Spine Associates (CNSA) in Charlotte, North Carolina for 25 years. He now serves as the Director of Atrium Health's Spine Center of Excellence. He is the Jerry and Audrey Petty Endowed Professor of Spine Surgery at Atrium Health and has served as Chief of the Department of Neurosurgery at Carolinas Medical Center from 2005 to 2019. He was elected to Phi Beta Kappa and graduated cum laude with a B.S. from Duke University. He received an M.D. from Wake Forest University and was elected Alpha Omega Alpha. He completed his general surgery internship and neurological surgery residency at Wake Forest University Baptist Medical Center.

Dr. Coric's professional interests lie in acquiring expertise in and conducting research on spinal motion preserving techniques, including cervical and lumbar arthroplasty as well as spinal trauma, spinal cord injury and interbody fusion for degenerative diseases. He has served as a Principal Investigator in over 30 IDE/IND trials and was national Lead, or co-Lead, Investigator in 10 IDE/IND trials. He has contributed more than 150 peer-reviewed articles and over 18 book chapters to scientific literature. He is a prolific speaker, having delivered hundreds of lectures both nationally and internationally across Europe, Asia and Australia. Dr. Coric is actively involved in various neurosurgical and orthopedic spine societies. He is past-President of the Southern Neurosurgical Society, North Carolina Spine Society, and International Society for the Advancement of Spine Surgery (ISASS). He is past-Chair of AANS/CNS Joint Section on Spine and Peripheral Nerves. He currently serves on the AANS Board of Directors.

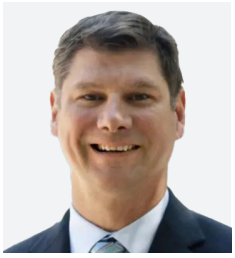


DR. RICHARD GUYER is a board-certified orthopedic spine surgeon and is one of the founders of the Texas Back Institute and currently serves as its President. He also serves as the Chairman of the Board of Directors for the Texas Back Institute Research Foundation and has been Director of the Spine Surgery Fellowship program since its inception in 1986. Dr. Guyer completed his medical school and residency training at the University of Pennsylvania School of Medicine and completed two spine fellowships, one at Case Western Reserve University with Henry Bohlman, MD in Cleveland, Ohio and the other with Leon Wiltse, MD in Long Beach, California.

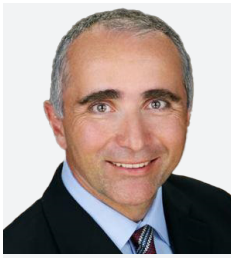
Dr. Guyer holds many patents in spine surgery and has published approximately 100 peer-reviewed articles, presenting his research at national and international spine conferences. While the majority of the research work has dealt with the diagnosis and treatment of painful degenerative spinal conditions, he is also one of the pioneers in lumbar and cervical disc replacement. In 2000 he performed one of the first disc lumbar disc replacements in the USA and has been an investigator in nearly a dozen US IDE studies of both cervical and lumbar disc replacements. He continues to research and publish in this area as well as in motion preservation and minimally invasive treatments. Dr. Guyer has been very active with various spine societies including NASS, CSRS, ISSLS, and ISASS serving as President of NASS during the 2006-2007 year and various committees of the ISASS. He was recently appointed to the Board of Directors of the American Board of Spinal Surgery.

DR. HYUN BAE is the medical director of Spine Education and clinical professor of Surgery and Orthopaedics at Cedars-Sinai. He is a national leader in minimally invasive surgery, motion preservation technology, artificial disc replacement and non-fusion technologies. As a leading researcher in stem cell repair of degenerative discs and the use of growth factors to treat spinal cord injury, Dr. Bae has published extensively in top journals and has presented at many national and international meetings. He was among the first to use growth factor tissue engineering for intervertebral discs, multilevel artificial disc replacement for both the lumbar and cervical spine, and other novel medical devices for dynamic stabilization and minimally invasive spine surgery. Dr. Bae earned a bachelor's degree in biomechanics from the Columbia University School of Engineering and Applied Sciences. He then went on to earn his medical degree, cum laude, at Yale University School of Medicine. His research interest is on the regulation of inflammatory and catabolic proteins in human intervertebral disc cells and tissues with and without mechanical stimulation. In addition, he is testing potential biological treatments for a reduction of inflammatory and catabolic processes in vitro and in vivo.

DR. ALEXANDER BUTLER is a board-certified spine surgeon at Lenox Hill Hospital and Lenox Health Greenwich Village in Manhattan, NYC. Dr. Butler serves as Assistant Professor in Orthopaedic Surgery at the Donald and Barbara Zucker School of Medicine at Hofstra/Northwell. He is trained in the management of a wide range of spinal conditions by several preeminent leaders in the field from both orthopaedic and neurosurgical backgrounds. He has a special interest and clinical focus in minimally invasive surgical techniques and procedures. As an active member of several professional societies committed to the advancement of the field of spine care and surgery, Dr. Butler regularly publishes and presents research investigating minimally invasive spine surgery and surgical outcomes. Originally from New Jersey, Dr. Butler lives with his wife and daughters in New York City. He enjoys golf, travel, and all aspects of physical and mental fitness.



DR. MATTHEW GORNET is a board-certified spine surgeon who specializes in the treatment of patients with low back and neck pain and practices at the Orthopedic Center of St. Louis. A fellowship-trained specialist in spinal surgery, he has authored several published books, chapters, and research papers. He is considered a national leader in the development of dynamic stabilization, disc replacement, and "non-fusion" technology. Dr. Gornet attended the Johns Hopkins University School of Medicine and completed surgical residencies at Johns Hopkins Hospital. Today, Dr. Gornet is a member of the North American Spine Society, Kostuik Society, International Society for the Advancement of Spine Surgery, American Association of Orthopedic Surgeons, Orthopedic Research Society, and AOSpine.



DR. ARMEN KHACHATRYAN is a board-certified orthopedic spine surgeon. He has devoted his entire career to spinal motion preservation technology, specifically to artificial disc replacements. Dr. Khachatryan was among the first to implant artificial discs in Utah, both in the lumbar and cervical spine. He is a firm believer in preserving motion with disc replacement surgery instead of traditional fusion

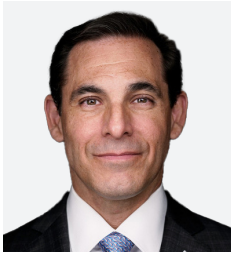
surgery. In 2013, Dr. Khachatryan established The Disc Replacement Center – the first of its kind in Utah. This Center has continued to further research and education in disc replacement technology and provide an alternative to fusion for patients both in Utah and across the globe. Patients have travelled both domestically and internationally to consult and receive surgical care from Dr. Khachatryan based on his expertise and approach.

DR. TODD LANMAN is a Diplomate of the American Board of Neurological Surgery, a Fellow of the American College of Surgeons, a Fellow of the American Association of Neurological Surgeons (FAANS), and an associate clinical professor at UCLA. Dr. Lanman earned his M.D. at Chicago's Northwestern University with top honors and his residency in neurological surgery at the University of California at Los Angeles. He has since led his own spinal neurosurgery practice in the heart of Beverly Hills, affiliated with Cedars-Sinai Medical Center, UCLA Medical Center, and Surgery Center of Beverly Hills. Dr. Lanman is a leading innovator in medicine, having published multiple peer-reviewed articles and book chapters on topics relating to spine surgery and orthopedic and neurological conditions. He has presented many papers at national and regional medical society meetings and served as Principal Investigator for various clinical trials on motion preserving surgeries. Dr. Lanman remains at the forefront of technological advancement, particularly in the development of artificial disc devices.

One of the things that sets Dr. Lanman apart is his personal experience with spine surgeries, having undergone eleven procedures himself. This firsthand knowledge fuels his passion for helping patients live pain-free with restored mobility. He employs a holistic approach to treatment, considering factors such as lifestyle, nutrition, and overall health in addition to spine and joint conditions. Dr. Lanman is known as Hollywood's go-to specialist for A-list celebrities, musicians, and executives. As the founder of the ADR Spine Top Doctors program, he has established himself as a leading innovator in spine surgery and artificial disc replacement.

DR. FRANK PHILLIPS is an Endowed Professor and Spine Fellowship Director at Rush University Medical Center in Chicago. A visionary in the field of minimally invasive spine surgery, Dr. Phillips was one of the first in Chicago to begin using these procedures in the 1990s. He specializes in minimally invasive cervical and lumbar reconstructive surgery as well as in motion preserving procedures and was a Principal Investigator in numerous FDA trials on spinal disc replacement. Dr. Phillips is a leader in the field and is a Founder, board member, and past-President of the Society of Minimally Invasive Spine Surgery (SMISS). Dr. Phillips has participated in the development of and pioneered a number of minimally invasive spinal techniques that are now widely used. He regularly teaches and lectures to spine surgeons nationally and internationally on minimally invasive spinal surgery.

DR. NAJEEB THOMAS is a native of Louisiana and practices in his home city of New Orleans. He completed a residency in neurosurgery at Louisiana State University Health Sciences Center in New Orleans. He trained at the world-famous Charity Hospital in New Orleans. He completed special training in complex and minimally invasive spinal procedures in Memphis, Tennessee under the direction of Kevin T. Foley, M.D. He has lectured about spinal procedures on four continents and has had interactions with hundreds of surgeons around the world. He is recognized as an innovator and continues to be active in the latest development of minimally invasive spine procedures so that his patients may receive the most advanced spine care in the world. His other interests include regenerative technologies for patients with spinal pathologies. He is both past President and Secretary-Treasurer of the Louisiana Association of Neurological Surgeons.



DR. LUIS TUMIALÁN is a Professor of Neurosurgery at the Barrow Neurological Institute specializing in minimally invasive spinal surgery. He graduated from Georgetown University School of Medicine, completed his internship at the Naval Medical Center in San Diego, and completed additional training in undersea medicine in Groton Connecticut and Navy Dive School in Panama City, Florida. He served as the Diving Medical Officer assigned to Naval Special Warfare Unit One in Guam during the Global War on Terror in the aftermath of September 11th, 2001. He received a Naval and Marine Corps Commendation Medal for service in support of Operation Enduring Freedom in Southeast Asia and a Navy Humanitarian Medal for the search and maritime rescue of a foreign national. Afterwards, Dr. Tumialán completed his neurosurgery training at Emory University School of Medicine and returned to the Naval Medical Center in San Diego. He joined Barrow Brain and Spine in 2010 where he serves as the Director of minimally invasive spine surgery. Dr. Tumialán's main interests are in minimally invasive spinal surgery and motion preservation surgery as well as developing techniques for the next generation of spinal surgery.

Dr. Tumialán served as the Scientific Program Chairman and Annual Meeting Chairman for the AANS/CNS Spine Section, and currently serves as Secretary. He served as the Scientific Program Chair for the Society of Minimally Invasive Spinal Surgeons (SMISS) and the International Society for the Advancement of Spinal Surgery (ISASS) and currently serves as the Secretary of ISASS. Dr. Tumialán serves as Director for the American Board of Neurological Surgeons (ABNS). His interest in socioeconomics led him to the Council of State Neurosurgical Societies (CSNS) where he served as Treasurer, Corresponding Secretary, and is currently the Vice Chair. Dr. Tumialán is on the editorial board for both the Journal of Neurosurgery: Spine and Associate Editor for Operative Neurosurgery. He has authored over 100 peer reviewed publications and over 20 book chapters on spinal surgery. In 2020, Dr. Tumialán published a single-authored textbook entitled, "Minimally Invasive Spine Surgery: A Primer."

DR. JACK ZIGLER specializes in spine surgery at the Texas Back Institute in Plano, TX. He is a former Clinical Professor of Orthopaedic Surgery at USC, Chief of the Spinal Injury Service at Rancho Los Amigos Medical Center and has been President of both the American Spinal Injury Association (ASIA) and the International Society for the Advancement of Spine Surgery (ISASS). As a Fellowship Director, Dr. Zigler has trained more than 130 spine surgeons. He has served on dozens of committees for Orthopaedic and Spine societies. Dr. Zigler received a B.S. with distinction at Cornell University and his M.D. cum laude at the SUNY Upstate Medical Center in Syracuse, New York, where he was a member of the Alpha Omega Alpha Honor Medical Society. Following completion of a Residency in Orthopaedic Surgery at the Mount Sinai School of Medicine in New York City, Dr. Zigler completed the prestigious Arnold Fellowship in Spine Surgery at Case Western Reserve University in Cleveland, Ohio with Henry Bohlman, M.D. from 1981-1982.

Since year 2000, Dr. Zigler has sub-specialized in motion preservation using artificial disc replacements in both the lumbar and cervical spines. He has served as the Principal Investigator or sub-Investigator on over a dozen FDA/IDE trials. He has authored over 95 peer-reviewed articles, 3 textbooks, over 20 textbook chapters, and has given more than 300 presentations at national and international spine meetings. Dr. Zigler has trained several hundred Orthopaedic and Neurological Surgeons on the implantation of disc replacement devices and has been the primary author on many seminal publications reporting the clinical outcomes of disc replacement versus fusion.

The Medical & Scientific Board

NATIONAL SPINE HEALTH FOUNDATION

Board of Directors

OFFICERS

Thomas Schuler, MD | Board Chair | Founder, Virginia Spine Institute

Jamie Harvey | Vice-Chair | Pricewaterhouse Coopers

Gordon Taylor | Treasurer and Finance Committee Chair | VSI

Jennifer Marron | Secretary | Community Activist

BOARD MEMBERS

Todd Albert, MD | Scientific Committee Chair | Hospital for Special Surgery

Edward Albers | Governance Committee Chair | New River Systems

Patrick Collins | Atlantic Coast Mortgage

Christopher Good, MD | VSI

Lawrence Lenke, MD | Columbia Orthopedics Och Spine Hospital

Eric Major | Fund Development Chair | Spine Industry Executive

Brian Nault | Immediate Past Chair | Tetratech/BlueWater Federal |

Ray Pugsley | National Race Liaison | PR Run&Walk

Rajiv Sethi, MD | Medical and Scientific Committee Chair |
Virginia Mason Franciscan Health

EX OFFICIO

Rita Roy, MD | CEO

Dave Poley | Executive Director

Philanthropy: The Power to Transform Lives

Empowering Spine Health Journeys

At the National Spine Health Foundation, our mission is clear: to empower individuals with knowledge about treatment options and prevention strategies to live free from spine-related pain and limitations. We collaborate with renowned spine practitioners to bring trusted, unbiased information.

OUR COMMITMENT

KNOWLEDGE

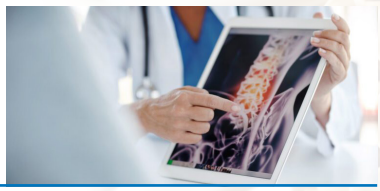
Offer comprehensive resources on various paths to find the best solutions.

COMMUNITY

Provide a haven of support for those navigating spinal conditions.

RESEARCH

Propel advancements through patient-focused innovation.



PREVENTION

Ensuring spinal health through proactive wellness and prevention strategies.

SCAN TO WATCH!

A message from Rita Roy, MD, NSHF CEO, provides insight on the impact of donor support!

JOIN US in creating a future free from spine-related suffering and pain.

Find out more at SPINEHEALTH.ORG

NATIONAL
SPINE HEALTH
FOUNDATION

Empowering Spinal Health This Journal is Made Possible by NSHF Donors. Your Support Fuels Our Mission. Scan the QR Code and **Donate Today** to Keep Knowledge and Hope Alive!

National Spine Health Foundation
11800 Sunrise Valley Drive, Suite 330
Reston, VA 20191
Phone: (703) 766-5405
Email: info@spinehealth.org