



SPINE ANATOMY & SPINAL ISSUES

Understanding the anatomy of the spine can be helpful in determining the possible source of your symptoms and educating yourself so that you can have more informed conversations with your doctors.

ABOUT THE SPINE

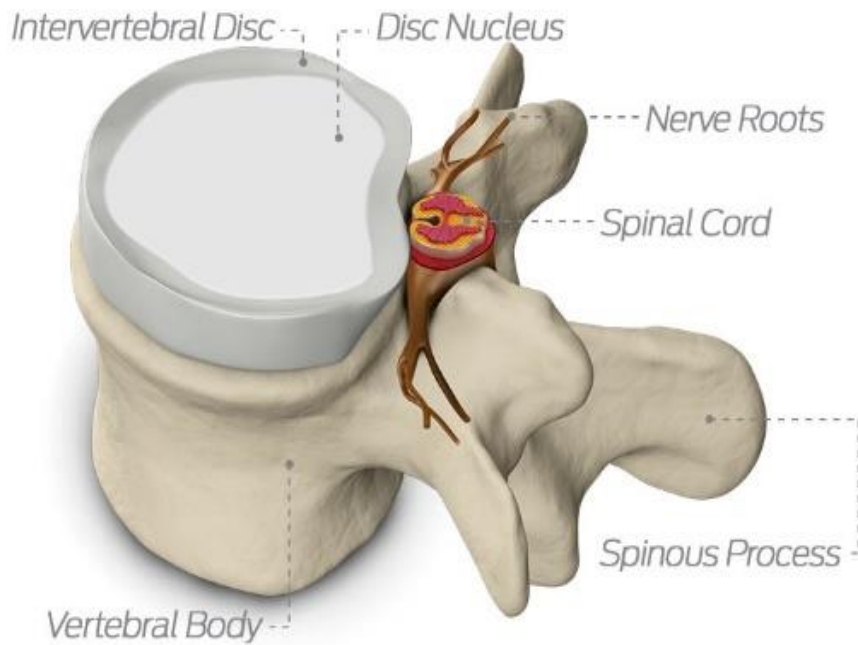
The human spine is divided into 4 distinct sections of bones known as “vertebrae”. At the top of the spinal column, the cervical spine (or neck) is made up of 7 vertebrae. Just below with 12 vertebrae, the thoracic spine comprises the mid-torso section of the human body. Below that is the lumbar spine with 5 vertebrae. Finally, at the very bottom of the spinal column—in the area of the hips—is the sacrum, the triangular-shaped portion made up of 5 fused bones.



All voluntary movement in your body is controlled by the brain, whose main communication pathway to the muscles is a large bundle of nerves collectively known as the spinal cord. Protection for this critical pathway is provided by the bones of the spinal column.

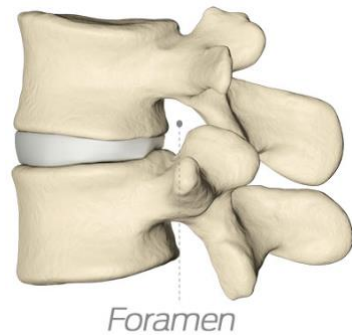
These bones, or vertebral bodies, have a number of important functions—one is to encircle and guard the spinal cord against trauma and another is to provide the skeletal support we need to walk upright.

YOUR SPINAL DISCS



Between each pair of vertebrae is a spinal disc that acts like a shock absorber and provides flexibility during your daily activities.

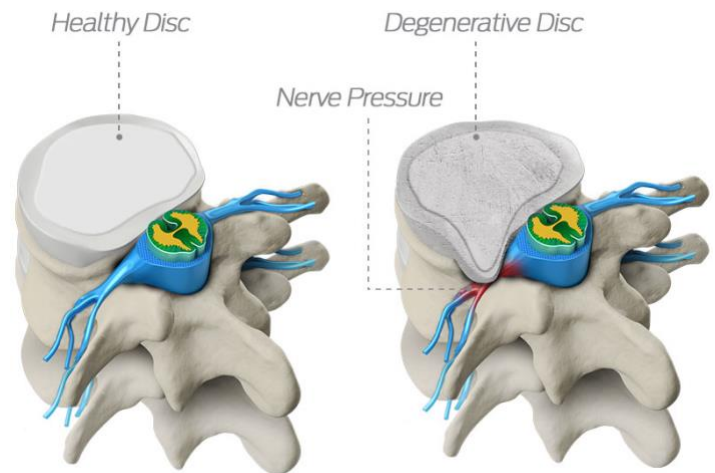
The combination of the spinal disc and the attached vertebral bodies is called a spinal segment or level. At each spinal segment, nerves branch from the spinal cord and pass through openings between the vertebrae called foramen. These nerves travel to the arms and legs to control movement and relay sensation back to the brain.



SPINAL ISSUES CAN CAUSE PAIN & DISCOMFORT

DEGENERATIVE DISC DISEASE, OR "DDD", ISN'T A DISEASE AT ALL

Your spinal discs act as a cushion to absorb shock between the vertebrae during movement. As a result of aging or injury, sometimes the spinal disc loses its cushioning effect which may result in a loss of disc height. This loss of disc height reduces the distance between the vertebral bodies and may cause irritation or pinching of the nerves. The spinal disc may also bulge or herniate, where the disc material contained within the intervertebral disc is pushed into the spinal canal. This may cause inflammation and pressure on the local nerve.

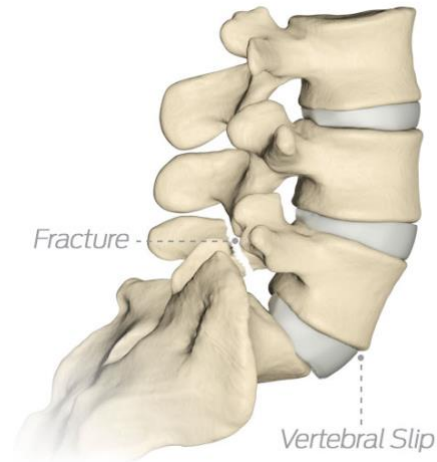


The loss of disc height and / or bulge of the disc may result in the following symptoms.

- Pain or discomfort in the neck or back
- Tingling or loss of feeling in arms or legs
- Shooting pain or discomfort in one or both legs
- Discomfort that worsens upon standing or activity

SPONDYLOLISTHESIS, OR "SPONDY" FOR SHORT

Spondylolisthesis is a condition usually caused by a sports related injury. Genetics may play a role in the likelihood of a spondy occurring in a person that plays football, gymnastics, or a similar sport. A spondy usually occurs in the lumbar spine or low back and is described as one bone or vertebra slipping or sliding forward over the vertebra below it. This forward or anterior position may lead to the spinal cord or a nerve being compressed or squeezed.



Sometimes when a vertebra slips out of place, there maybe no symptoms or a delay in the onset of symptoms. Patients with a spondy may experience the following symptoms:

- Pain in the low back or buttock area
- Pain may increase with coughing or sneezing
- Weakness, numbness or pain in one or both legs
- Hamstrings may feel tight
- Leg muscles may feel tight or weak

- Patients may limp or waddle
- Posture may change and the patient may lean forward
- Trying to stand maybe painful or difficult to achieve
- Loss of bladder or bowel control may occur

SPINAL CURVATURES: LORDOSIS, KYPHOSIS, AND SCOLIOSIS

The human spine normally curves to aid in stability or balance and to assist in absorbing shock during movement. These gentle curves can be seen from the side or lateral view of the spine. When viewed from the back, the spine should run straight down the middle of the back.

When there are abnormalities or changes in the natural spinal curvature, these abnormalities are named with the following conditions and include the following symptoms.

LORDOSIS

Some lordosis is normal in the lower portion or, lumbar section, of the human spine. A decreased or exaggerated amount of lordosis that is causing spinal instability is a condition that may affect some patients.

Symptoms of Lordosis include:

- Appearance of sway back where the lower back region has a pronounced curve and looks hollow with a pronounced buttock area
- Difficulty with movement in certain directions
- Low back pain



KYPHOSIS

This condition is diagnosed when the patient has a rounded upper back and the spine is bent over or curved more than 50 degrees.

Symptoms of Kyphosis include:

- Curved or hunched upper back
- Patient's head that leans forward
- May have upper back pain
- Experiences upper back discomfort after movement or exercise



SCOLIOSIS

The most common of the three curvatures. This condition is diagnosed when the spine looks like a “s” or “c” from the back. The spine is not straight up and down but has a curve or two running side-to-side.

Symptoms of Scoliosis include:

- Uneven shoulders or shoulder blades causing one to sit higher than the other
- Uneven rib cage or hips causing one to sit higher than the other
- Misaligned head or neck that may not be centered over the spine
- Patient’s body may lean to one side
- May experience back pain



SPINAL INSTABILITY



Spinal instability is described as the abnormal sliding or hypermobility of the bones or vertebrae of the spine. This sliding may occur during flexion (bending forward), lifting or extension (bending backward). When a disc is injured or degenerates it may lose tension or its tight grip on the vertebrae above and below it. This loss of tension allows the bones to shift or slide in abnormal directions which may irritate or pinch a nerve.

Spinal instability may not immediately cause symptoms or the onset of symptoms may occur over time. Spinal instability may be associated with the following symptoms.

- Stabbing neck or back pain when a person stands up
- Patient’s neck or back may lock up or get stuck during movement
- Neck or back muscles spasm
- Weakness or numbness in the arms or legs

SO WHAT ARE MY TREATMENT OPTIONS?

The good news is there are several treatment options available to you.



Every person responds to treatment differently and it's important to educate yourself and work with your doctor(s) to find the options that work best for your situation. Whether you're exploring conservative care or seeking a surgical solution, we have information for you.

WHAT ARE THE OPTIONS FOR TREATING SPINAL CONDITIONS?

Your doctor will likely first use treatment options such as physical therapy, heat, and anti-inflammatory medications. For the vast majority of patients, pain will subside over time using these types of conservative methods.

Additional forms of treatment may become necessary—such as injections and nerve root blocks. If found effective, these treatments can be performed several times by a pain management physician or physiatrist. These injections work by decreasing inflammation and, ultimately, the pain from irritated nerves.



If conservative forms of treatment fail to relieve your symptoms, then surgery may be presented as an option.

WHAT IS SPINAL FUSION?

Spinal fusion is a surgical procedure where two or more vertebra are fused, or connected, together to permanently eliminate all motion in the spine at that level. Spinal fusion involves removing the patient's diseased disc and inserting a device to allow bone growth between two vertebral bodies—essentially fusing two vertebral bodies into one rigid segment.

SPINAL FUSION SURGERY



Spine surgery can be performed utilizing an anterior (front), approach through an incision in your abdomen or neck. A lateral (side) approach uses an incision in your side. A posterior (back) approach may also be used through an incision in your back or the back of your neck. There are several advantages to using an anterior approach, including: less muscle disruption, greater anterior column support (80% of the load on your spine goes through the anterior column), and the ability to place a larger implant to better fusion. During spinal fusion surgery, the diseased spinal disc is removed.

An interbody device is inserted in the spine to replace the diseased disc. Sometimes, the surgeon may also insert a metal plate that bridges the adjacent vertebral bodies to stabilize the spine.

Alternatively, your surgeon may use an "integrated interbody" device—a single device that replaces the diseased disc. The integrated device is then secured with specially-designed screws.

SPINAL FUSION

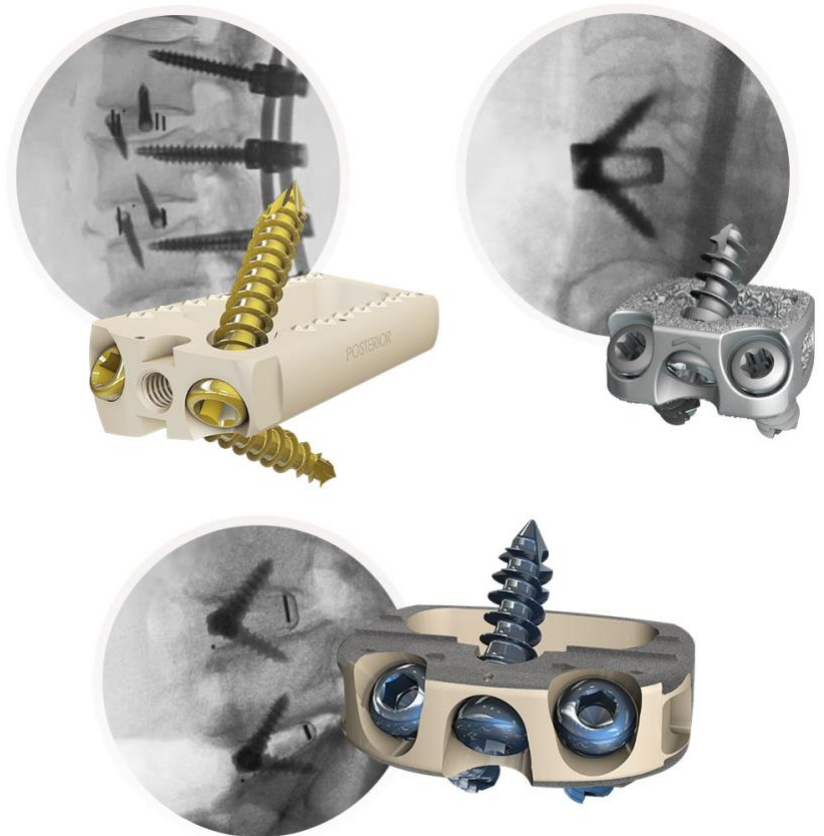


Spinal fusion may be a solution for some patients with degenerative disc disease who are not candidates for total disc replacement—providing the stability and security needed to help the spine heal.

about STALIF®

STALIF is an Integrated Interbody fusion platform that offers a surgical treatment proven to restore spinal balance, recreate spinal alignment and stability, and accelerate the return to normal activities.

Centinel Spine was the first company in the world to offer Integrated Interbody (a.k.a. Stand-Alone) fusion devices, and has a long clinical history in providing fusion solutions that conform to patient anatomy and capitalize on the body's ability to heal itself.



Available devices include:

- **STALIF M™**: Anterior fusion device for the lower (lumbar) spine (L2-S1), available in 3 material options (PEEK, PEEK with **Ti-ACTIVE™**, and **FLX™**)
- **STALIF L®**: Lateral fusion device for the lower (lumbar) spine (L2-L5), available in 2 material options (PEEK and **FLX**)
- **STALIF C®**: Anterior fusion device for the upper (cervical) spine (C2-T1), available in 3 material options (PEEK, PEEK with **Ti-ACTIVE**, and **FLX**)

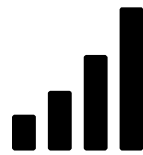
STALIF usage

The 1st implantation of a **STALIF** device took place in 1988. Since the very first device was implanted until now, Centinel Spine has continued to innovate and improve upon its original **STALIF** design, with state-of-the-art solutions now existing in multiple material options and device sizes to best suit each patient's unique needs.

The **STALIF** line of Integrated Interbody fusion implants are the longest implanted line of Integrated Interbody devices in the world.

30+

30+ Year Clinical History with Worldwide Usage



Unparalleled clinical & biomechanical data, with average fusion rates of 92-95% ^{1,2,3}



More than 66,000 device implantations and a reported reoperation rate of less than 1%

STALIF design

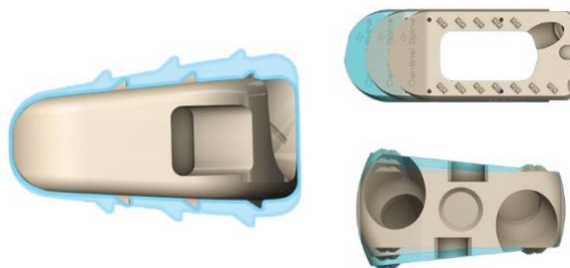
STALIF technology incorporates a proven design rationale based on AO principles of fracture fixation and Wolff's Law of Bone Healing.

WOLFF'S LAW & THE LAG EFFECT

Wolff's Law of Bone Healing states that bone grows where load is applied. That is why STALIF devices utilize specially designed screws that pull the spinal bones at the fusion site down to the device, in what is known as a "lag effect"—providing an active load to aid in the healing process.

ADDRESSING EACH PATIENT'S NEEDS

STALIF devices are also designed to conform to patient anatomy. They come in a variety of sizes, heights, angles, and materials to fit each patient's needs and offer the best chance of successful outcomes.



STALIF objectives

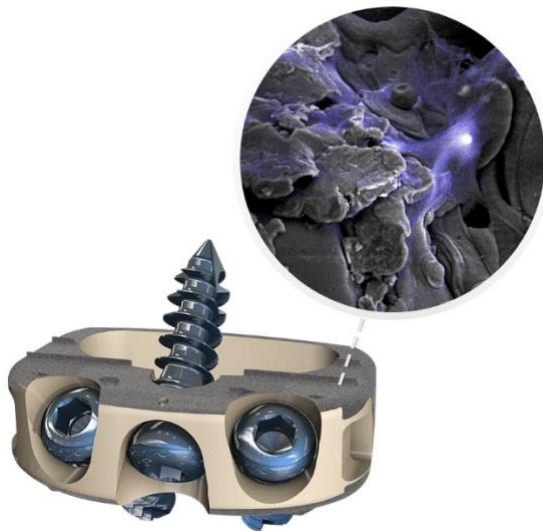
STALIF was developed with several specific patient care objectives in mind:

RESTORING SPINAL ALIGNMENT

STALIF devices are designed to conform to patient anatomy. They come in a variety of sizes, heights, and angles to fit each patient's needs, so that spinal curvature, height, and alignment can be restored, offering the best chance for successful outcomes.



ENHANCING OPPORTUNITIES FOR FUSION



STALIF devices come in a variety of material options to enhance opportunities for fusion based on patient specific needs. Some **STALIF** implants incorporate materials, such as titanium, that are known to be cell-friendly and attract bone cells. They also have very large cavities that allow for a large amount of bone to form between the vertebral bodies to make a solid fusion. Combining these features with the compressive design and the ability to pick an implant that fits each patient's anatomy optimally enhances opportunities for successful fusion outcomes.

RESUMING ACTIVITIES OF DAILY LIVING

Degenerative disc disease can be very painful, and recovery from spinal surgery can take time. Special care has been taken to design **STALIF** devices to minimize the recovery associated with the procedure. **STALIF** devices are implanted from the front (anterior) of the body, going in through either the abdomen (ALIF), side (LLIF), or throat (ACDF), so stabilizing spinal muscles and bony elements are not disturbed. Studies have shown that compared to more invasive fusion procedures that approach the spine by going in through the back (posterior), patients who receive fusions from anterior approaches have shorter hospital stays (1-3 days vs. 3-6 days), mobilize more quickly (many patients are walking the same day they have surgery), and lose much less blood during the procedure.



STALIF devices are also designed to be fully contained within the anatomy of the spinal bones, so the risks of post-operative complications associated with other body anatomy, such as difficulty swallowing (dysphagia), are minimized.

STALIF studies

With a clinical heritage of more than 30 years, **STALIF** has been extensively studied.

After multiple published studies, the clinical & biomechanical data for **STALIF** strongly supports its safety and effectiveness. Here are just a few key takeaways from these numerous studies:

92-95%

OBSERVED FUSION RATES

Better than or comparable to reported rates using traditional plate & cage constructs ^{1,2,3}

MINIMALLY

DISRUPTIVE TECHNOLOGY

Lower instances of adjacent segment degeneration and an 85% reduction in reported instances of dysphagia vs traditional plate & cage constructs ^{4,5}

STRONG

BIOMECHANICS & STABILITY

*No Profile **STALIF** devices are a safe alternative to rigid anterior plating for 1 or 2 level cervical fusion procedures and **STALIF** lumbar devices with 3-screw fixation provide equivalent motion restriction to a construct with an anterior non-integrated cage & posterior pedicle screw fixation*

WORKING WITH your insurer

THE PATIENT ASSISTANCE LINE

While the vast majority of insurance plans cover **STALIF**, some fusion devices may be considered investigational by your insurance provider. Though reimbursement coverage for stand-alone fusions continues to increase, not all insurance companies cover these procedures. Centinel Spine offers a Patient Assistance Line (PAL) to qualified patients to help them to navigate insurance coverage for this surgery.

If you are not covered by your insurance provider, the PAL (Patient Assistance Line) is available to help you gain coverage for **STALIF** procedures. The PAL is a reimbursement support service that assists YOU, the patient. Your PAL is dedicated to assisting YOU and working together with your surgeon, medical office, and insurance provider.

CALL (800) 264-4623

MONDAY - FRIDAY

9AM - 5PM EST



Important Patient Information: The resources provided on this site are for informational purposes only. This website is not a replacement for professional medical advice. You should discuss both surgical and nonsurgical treatment options with your doctor. Only your doctor is qualified to diagnose and treat your condition.

Problems can occur when you have spine surgery, including surgery with STALIF implants. There is a risk that the surgery may not make you feel better or may cause you to feel worse. If this happens, you may need another surgery to help you feel better. View the specific problems that can occur during or after STALIF M, STALIF C, or STALIF L surgery.

Reimbursement is dynamic. Coding, coverage and payment are subject to change. Centinel Spine cannot guarantee reimbursement for any procedure associated with the use of its products. Providers should contact their specific payers if they have questions regarding coding, coverage or payment.

1. Elshihabi, Said, "A Retrospective Clinical and Fusion Analysis of the Device with Stem-Cell Derivative Bone Graft Material", Presented at The Southern Neurosurgical Society's 66th Annual Meeting, Naples, FL., March 2015.
2. Lane, Paul, et al., "Early Radiographic and Clinical Outcomes Study Evaluating an Integrated Screw and Interbody Spacer for One- and Two-Level ACDF", *The International Journal of Spine Surgery*, 9(39). CI: 10.14444/2039.2015.
3. Vokshoor, Amir, et al., "Retrospective Clinical Outcome Study Evaluating the Efficacy of the Stand-Alone Cervical Device in Anterior Cervical Discectomy and Fusion", Presented at The ISASS 15th Annuas Conference, San Diego, CA, April 2015.
4. Smucker JD et al.; *Comparison of Long-Term Differences in Dysphagia: Cervical Arthroplasty and Anterior Cervical Fusion. Clinical Spine Surgery*, 2016.; dio:10.1097/BSJ.0000000000000401
5. Alimi M. et al.; *Anterior Cervical Discectomy and Fusion (ACDF): Comparison Between Zero Profile Implants and Anterior Cervical Plate and Spacer. Cureus*, 2016; doi:10.7759/cureus.573