Body Mechanics

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To Flex or Extend?

When a client presents with a pathologic lumbar disc, there is a divide in the world of manual and movement therapy: Do we treat the client with flexion or do we avoid flexion and instead treat the client with extension? There are proponents for each method, and unfortunately these proponents often divide along rigid ideological lines, each one believing that their approach is the superior one. As is often the case, whenever two differing treatment approaches exist, usually both are valid. So how do we decide which method to use with the next client who presents with a pathologic disc?

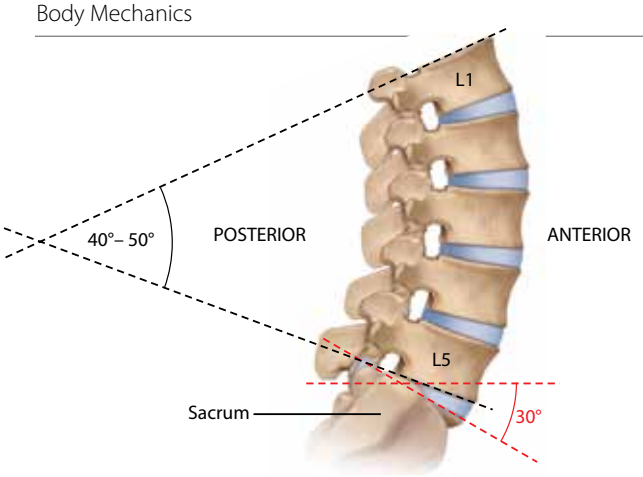


Figure 1. The lumbar spine has a normal lordotic curve of approximately 40-50 degrees.

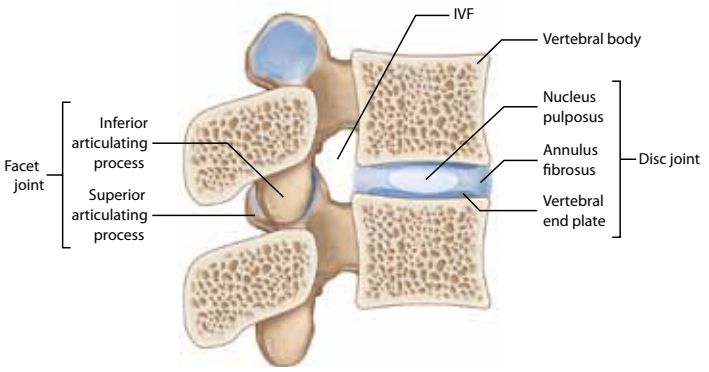


Figure 2. Disc and facet joints of the spine. Intervertebral foramen, IVF.

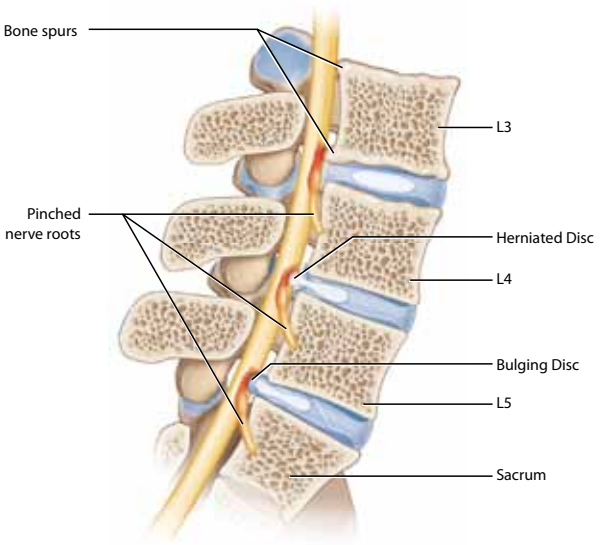


Figure 3. Pathologic discs compressing spinal nerves. A bulging disc is seen at the L5-S1 disc and a herniated disc is seen at the L4-L5 disc. Osteoarthritic (degenerative joint disease) bone spurs are seen on the body or L3.

As with all clinical orthopedic work, the answer lies in choosing the correct treatment approach based on the specific pathomechanics of the client's condition and the needs of the client at that moment. Not all pathologic disc conditions are the same, and therefore not all clients with a pathologic disc condition will respond the same. Making the best decision requires a clear understanding of biomechanics, which ultimately rests on a fundamental understanding of musculoskeletal anatomy and physiology, in other words, kinesiology.

Note: Because a pathologic disc is potentially a very serious condition, with possible permanent effects, it is important to refer any client who presents with this condition to a physician. Referral does not mean that the client cannot also be treated at the same time by a massage therapist. A client with a pathologic disc condition can be under the supervision of a physician and also benefit from massage and other manual therapies.

The Lumbar Spine

The lumbar spine is composed of five vertebrae that sit on the base of the sacrum. Because in anatomic position the pelvis/sacrum is anteriorly tilted approximately 30 degrees, there is a natural lordotic curve to the lumbar spine. The healthy lordotic curve varies from individual to individual, but on average is approximately 40-50 degrees (Figure 1).

Lumbar Spinal Joints

At each segmental level of the lumbar spine, there are three joints: an intervertebral disc joint located anteriorly, and paired left and right facet joints located posteriorly. The disc joint is composed of three major parts: cartilaginous vertebral endplates that cap the bodies of the vertebrae, a fibrous annulus fibrosus that is located circumferentially between the vertebral bodies, and a thick gel-like nucleus pulposus in the center bounded by the fibers of the annulus fibrosus. The facet joints are synovial joints, located between the inferior articular processes of the superior vertebra and the superior articular processes of the inferior vertebra. Each facet joint is bounded by a fibrous joint capsule containing synovial fluid; and the joint surfaces are capped with articular cartilage.

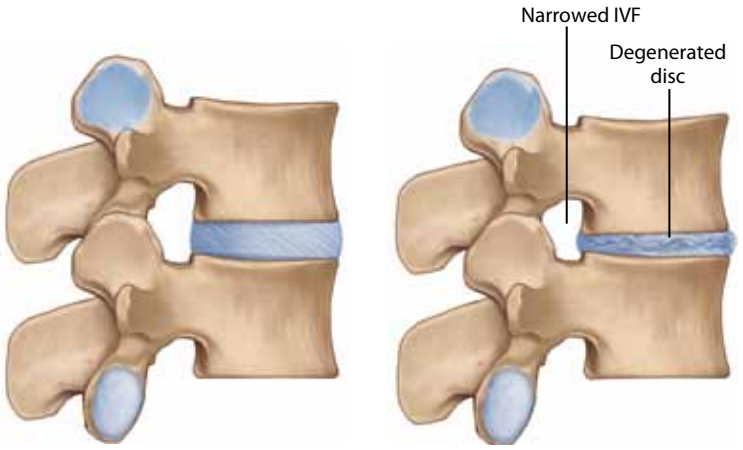
Also located between each two adjacent vertebrae are two intervertebral foramina (IVFs), through which the spinal nerves from the spinal cord pass. An IVF is formed by a notch in each of the two adjacent vertebrae, that when placed together form the foramen for the entry/exit of the spinal nerve (Figure 2).

Lumbar Joint Function

The degree of motion that exists in any region of the spine is primarily determined by the thickness of the discs, whereas the direction of motion best allowed is determined by the orientation of the fact joints. In the lumbar spine, the facet joints are oriented in the sagittal plane. For this reason, sagittal plane motions of flexion and extension occur freely in this region. From anatomic position, the lumbar spine allows approximately 50 degrees of flexion and approximately 15 degrees of extension. This totals 65 degrees of sagittal plane motion; quite impressive given that this motion occurs across only five segmental joint levels. In addition to motion, the spine is a weight-bearing structure; the lumbar spine must bear the weight of the entire body above it. The disc joints bear approximately 80% of the weight; the facet joints bear the remaining 20%. It is important to note that as weight bears through the disc joint, the nucleus pulposus is compressed, pushing it outward away from the center and against the fibers of the annulus. Weight bearing also affects the facet joints by compressing their joint surfaces.

Pathologic Disc

When the intervertebral disc is healthy, the nucleus is confined within the fibers of the annulus fibrosus. However, the accumulation of physical stresses to the disc can weaken the annular fibers. These stresses can be macrotraumas such as a car accident or a fall; and/or they can be repetitive stress microtraumas that occur due to such things as poor postures or the ongoing compression force of weight bearing. Regardless of the cause, if the annulus is weakened, weight-bearing compression upon the nucleus can cause it to bulge the annular fibers outward, creating what is known as a *bulging disc*. If the annular fibers are sufficiently stressed, they can rupture, allowing the nuclear material to extrude through the annulus; this is called a *ruptured disc*, *prolapsed disc* or *herniated disc*. Lumbar pathologic discs most often occur in the lower lumbar region, at the L4-L5 or L5-S1 joint levels (Figure 3).



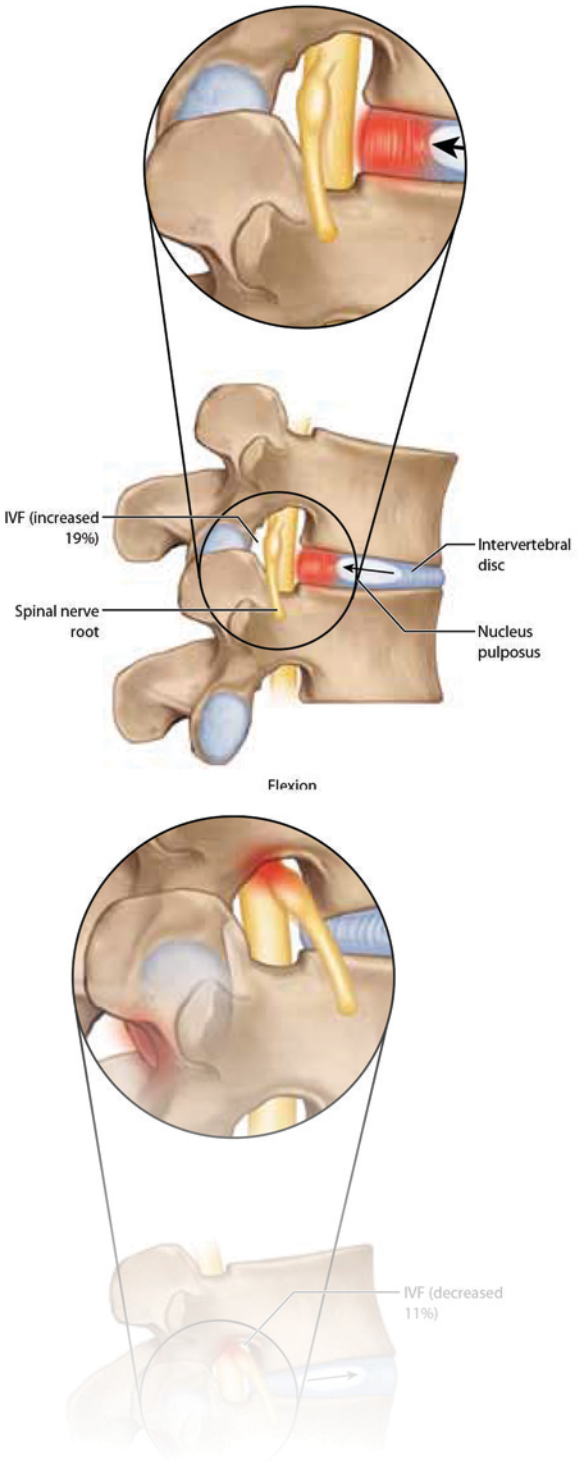
BOX 1

Degenerated Disc

In addition to bulging and herniated discs, there is third pathologic condition of the intervertebral disc known as degenerative disc disease (DDD). DDD involves breakdown/degeneration of the annular fibers and desiccation of the nucleus pulposus. This results in thinning of the disc, which can be seen on X-ray; the space that the disc occupies between the adjacent vertebral bodies will be decreased in height. DDD is a normal part of aging and is usually asymptomatic. But if it is advanced in degree, it can potentially cause symptoms. Thinning causes approximation of the vertebral bodes, which decreases the size of the IVFs, increasing the likelihood of nerve compression within the IVF (compare the healthy disc in Figure A with the degenerated disc in Figure B). Because DDD involves degeneration of the annulus, it also increases the chance that the annular fibers will weaken and bulge, or perhaps herniate. Interestingly, if the nucleus pulposus is sufficiently desiccated, it exerts less pressure against the annular fibers and the likelihood of a bulging or herniated disc actually goes down. This is why the incidence of nerve compression from pathologic disc conditions decreases in senior citizens.

Figures courtesy of Joseph E. Muscolino.

"Ultimately, the goal of all manual and movement therapy is graceful and pain-free functional motion."



Pain from a pathologic disc can occur due to the irritation of local structures, such as the annular fibers themselves or the posterior longitudinal ligament. However, the more serious consequences of a pathologic disc are usually due to compression of neural tissues. Because of how stress forces are usually placed on the intervertebral discs, bulging and herniation most often occur posterolaterally. When this occurs, the disc protrudes into the IVF and can compress the nerve root, causing symptoms into the lower extremity on that side (midline posterior bulges/herniations occur less frequently because the annulus fibrosus is reinforced in the midline by the posterior longitudinal ligament). Because the nerve roots of the lower lumbar spine contribute to the sciatic nerve, pathologic lumbar discs usually cause symptoms of sciatica referring down into the lower extremity.

Therefore, there are two major factors at play when a client has a bulging/herniated disc. One is the disc lesion itself, in other words, the weakened or ruptured fibers of the annulus fibrosis. The second is the encroachment within the IVF of the annulus or nucleus pressing on the nerve. Once the pathologic disc is present, a third factor occurs. Because of the irritation caused by the compression upon the nerve root, it usually becomes inflamed. Given that the IVF is a narrow closed space, there is little chance for the swelling to escape, so it remains in the IVF, further compressing the nerve root. It is often the size of the bulge/herniation plus the swelling that is responsible for the nerve compression and resulting symptoms. It is important to point out that the IVF can also be narrowed due to calcium deposition (bone spurs) at the joint margins; this condition is known as osteoarthritis or degenerative joint disease. When the size of the IVF narrows, it is also described as foraminal stenosis.

Flexion versus Extension

The question now becomes: What are the mechanical forces of flexion and extension upon the lumbar spine, and how do these forces affect the pathologic disc and nerve compression? It turns out that each movement has positive and negative effects upon the lumbar spine