

ANNULAR DISC TEARS

ANATOMY:

Normally the intervertebral disc, which is sandwiched between two vertebrae (white), contains a highly pressurized center called the **nucleus pulposus** (red). The nucleus is corralled or held in place by a strong cartilaginous material called the **annulus fibrosus** (blue). As long as the annulus is intact and strong, no nucleus pulposus can escape its. This is a very good thing since the posterior 1/3 of the annulus is filled with the pain-carrying nerve fiber of the **sinu-vertebral nerve**, which hates to be in contact with nuclear material.

An **annular disc tear** occurs when the substance of the annulus fibrosus "rips" or "tears" and allows that highly pressurized and potentially "evil" nucleus pulposus to escape outward toward the periphery of the disc (i.e., the outer edge). And if the annular tear reaches that outer 1/3 of the annulus, then there is a potential for big trouble to occur--i.e., PAIN--for as we have learned from the [Disc Anatomy Page](#), nuclear material, which contains evil biochemicals called cytokines, is often very irritating to the sensitive pain-carrying nerve fibers (sinu-vertebral nerves) that dwell in the posterior 1/3 of the human disc (see figure #1) and when contact between the two occurs, the patient can experience severe pain. This pain syndrome is called [Internal Disc Disruption](#) (see [Figure #2](#) below).

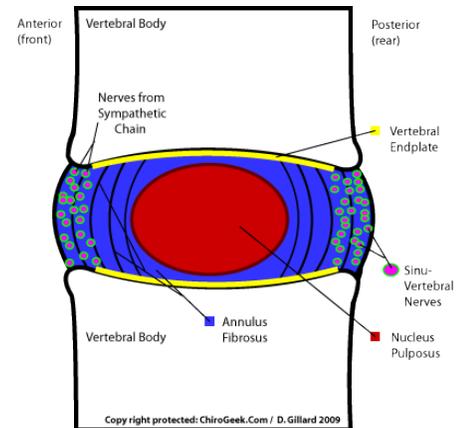


Figure #1: The Normal Disc
(View from the side--i.e. Sagittal View)

If the tear grows large enough to connect the nucleus with the periphery of the disc and then break through the final layer of the disc's periphery--the posterior longitudinal ligament--then the dreaded [disc herniation](#) will develop and may cause back and/or [leg pain](#) / weakness (or, if the tear occurs within the cervical discs, then neck and/or arm pain/weakness may develop).

THE CAUSE:

The usual cause of annular tearing is from a combination of [degeneration](#) and trauma; although, **genetics** may have an influence on the development of this syndrome. That is, some people have genes that produce a weak and inferior version of the human annulus fibrosus, which in turn is not strong enough to handle the everyday activity of work, play, and/or trauma--i.e., it tears too easily!

The pain that arises from an annular tear is called **discogenic pain** in doctorspeak and is easily the most difficult of all the disc syndromes to treat. In fact, unlike disc-herniation-induced sciatica, we have yet to develop an adequate treatment for this condition!

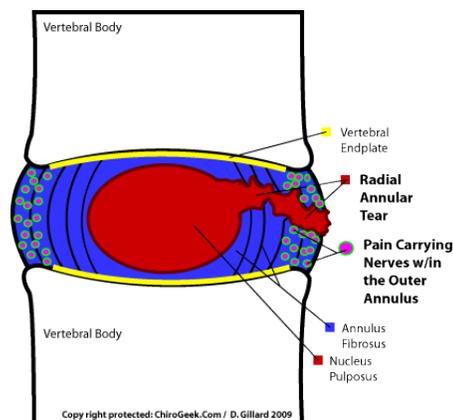


Figure #2: Disc w/ Radial Annular Tear
(View from the side--i.e. Sagittal View)

is usually a horizontally orientated annular tear that courses from the inner nucleus pulposus to the very outer region of the disc (see figure #2). Such tears often allow the pressurized nucleus pulposus to squirt through the tear, out the back of the disc and into the epidural space, which in turn may compress the adjacent nerve roots--such a condition is called a [disc herniation](#).

Besides being able to create their own horrible pain syndrome, which may be felt in the body above the involved disc(s)--i.e., in the back or neck and even down the associated extremity(s), annular tears can also give rise to the dreaded [disc herniation](#), which in turn may compress and/or chemically irritate the adjacent sciatic nerve rootlets causing the even more dreaded [sciatica](#) or radiculopathy in doctorspeak.

FLAVORS OF ANNULAR TEAR:

There are three main types of annular tears (aka: annular fissures) that occur in the human disc: The rim lesion which is a horizontal tearing of the very outer annular fibers of the disc near their attachments into the ring apophysis (i.e. the Sharpey's Fibers); the **concentric tear**, which is a splitting apart of the lamellae of the annulus in a circumferential direction; and the **radial tear**, which

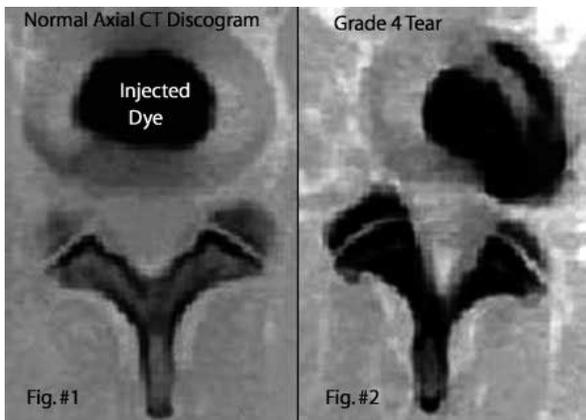
THE LONG RUN:

Another consequence of an annular tear occurs as the body attempts to fix these tears, which by the way may take 18 months to accomplish. Although the scar tissue that closes the tear is needed, the new pain-carrying nerve fiber growth is not. You see, recent medical research has demonstrated that new nerve fibers grow from the periphery of the disc into and down the annular tear--all the way into the nucleus in some cases! This is bad news, for it means that the healed disc is now filled with more pain-carrying nerve fibers than a normal disc, which makes it more susceptible to new tearing within the healed annular tear and pain--now the whole disc can feel, not just the outer 1/3.

A LITTLE MORE TECHNICAL DESCRIPTION:

Annular tears cause pain by irritating the well-innervated posterior 1/3 of the annulus. That's right, the disc does indeed have tiny nerve fibers embedded within the outer annulus and has the potential to generate pain (30). In fact, research has also demonstrated that blood vessels and nerve fibers have been seen growing into the inner annulus in 46% of chronic back pain patients, and even into the nucleus itself in 22% of the cases (31). Therefore, the degenerated disc of a 'disc tear survivor' may always be somewhat painful because of this nerve fiber ingrowth.

Another important clinical potential of peripheral annular tears is their ability to induce premature degeneration in the disc (5). Animal studies in the pig and sheep have demonstrated that induced rim lesions lead to severe premature degeneration of the disc, endplate, and facet joint in 100% of the tested discs. This is unconfirmed in humans for it is unethical to induce peripheral tears in humans, but since the discs of the pig and sheep are both amazingly similar to that of the human disc, it is quite possible that rim lesions in humans also will lead to rapid premature disc, end-plate, and facet degeneration as well.



Although even the most stubborn tear usually heals within 18 months, occasionally the tear and/or disc degeneration is too severe for the disc to heal on its own and surgery may become necessary: The IDET is designed to seal off a leaking radial tear; the Nucleoplasty is designed to shrink the volume of the disc which may be just enough to reduce a grade 5 radial tear and small protrusion and free up any minor nerve root impingement; and the last resort is the removal of the troublesome disc via fusion.

As we will learn in detail below, annular tears are not always seen on MRI, and never seen on x-ray. The best way to visualize annular tears is on **CT Discography**. A discogram is

performed by injecting contrast material into the center of the disc, and then watching to see if the dye leaks from that center along a radial tear. Figure #1 and #2 are examples of CT Discography. In **Fig. #1** the injected dye (black) does not leak out of the nucleus. This is normal. **Fig.#2** demonstrates a massive Grade 4 radial disc tear. Note how the contrast (black) has leaked out from the center of the disc through a massive complete radial tear. (See the Discography page for more information.)

The other, less invasive way, to confirm the presence of an annular disc tear is by MRI. To increase the chances of seeing a true annular tear on MRI, contrast may be added. Also, Cox Technique (flexion-distraction) is a form of decompression therapy which has been proven successful in most disc herniations.

