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Annular Tear or Fissure: The Great Masquerader

By Michael N. Brown, DC, MD, DABPMR-PAIN. Reprinted with permission.

INTRODUCTION:
The annular tear or fissure represents one of the most misunderstood conditions and under diagnosed conditions in low back pain patients. Yet, it represents one of the more common causes of chronic low back pain in orthopedic spine medicine today. I have named this condition the "great masquerader" because it masquerades as so many other types or causes of back pain. It is commonly misdiagnosed as a back strain, lumbosacral strain / sprain, a facet syndrome, a sacroiliac syndrome and herniated disc. One of the problems with this condition is that the patient may experience some improvements with conservative treatment on a temporary basis but then go on to fail to fully recover regardless of the conservative intervention attempted. These patients fail chiropractic and osteopathic manipulation and also fail physical therapy. Patient's were annular tears can become exercise intolerant often flaring with exercises prescribed by physical therapist in doctor's. These patients often have peripheral leg pain associated with this condition and yet an MRI can look quite unremarkable. In fact, the annular tear patient will often present with normal x-rays, MRIs, CAT scans and other common diagnostic tests and yet present with chronic pain.

These patients are often looked upon by physicians with a questionable eye because they fail to demonstrate any significant abnormality on diagnostic imaging. This problem is further complicated by the fact that there are so many medical, osteopathic, chiropractic and physical therapy professionals that are not trained and experienced to recognize the various annular tear syndromes that present clinically. There are practitioners who do recognize this condition and have developed the diagnostic skills to recognize these syndromes and are more comfortable treating them. This article is written for you to help you sort through the maze of choices in the journey to recovery. This also provides you a means of becoming a more informed consumer.

This article is recommended for any patient who has chronic back pain. The early disruption of the annulus and its effect on motion and stability of the spinal segments is actually at the heart of most mechanical causes of back pain.

The anatomy of the intervertebral disc:
The disc is made up of two primary structures; the *nucleus pulposis*, which is the center of the disc. This region of the disc is softer and less organized. I often say it has the consistency of "chicken fat"! The other portion of the disc is the *annulus fibrosis.* This outer portion of the disc is a well organized series of concentric laminated fiberous rings that surround the nucleus as shown in the pictures noted to the right. The nucleus is mobile within the disc. I refer you to the article on the "internal disc derangement" on our website for further information in this regard. In brief, the nucleus pulposus pulposis of the disc dynamically moves forwards and back during flexion and extension movements. When you bend forward the vertebral
segments close in the front thereby pushing the nucleus or fatty material into the back of the disc. When you bend backwards the vertebral segments and the back close and the posterior nucleus is pushed forward to the center of the disc. These movements can be used clinically as we have described in the other article "the intervertebral disc derangement". Of critical importance is the fact that there is a rich nerve supply with the outer fibers of the annulus of the disc.[1]

This portion of the disc is capable of producing significant back pain. The drawing above provides an illustration of a normal looking disc in a cross sectional view. Over time as the with the stresses that have been placed on the disc accumulate , the stress will break down the annulus.

The annular rings break down where tears and fissures can develop. It may surprise you to know that once the disc is torn, or when a fissure begins to develops, as seen in the picture to the right the disc does not heal. The disc has a poor healing potential.[2]

Once the disc has a weakened area or tear in the annulus, the disc is now vulnerable for further breakdown. Rather than this annular tear healing over time as you might expect, the tear actually propagates through the disc and begin to break down the disc.[3] The annular tear also destabilizes the spinal segment and begins to cause subtle spinal segmental instability. Once a tear in the disc is present some individuals can experience episodes of acute pain when a portion of the nucleus slips into the tear and becomes entrapped within the rings of the annulus. I have discussed this phenomena thoroughly in the "internal disc derangement" article on this website.

The following is a common scenario of an individual who has developed asymptomatic annular tear. An individual with no previous history of low back pain has ongoing going degeneration of the disc with changes in the annulus. This person now gets involved in a low speed rear end motor vehicle accident. As a result a previous asymptomatic tear of the disc is now extended further into the annulus. Now the tear reaches the outer fibers of the annulus. When this occurs the person now develops significant low back pain. This often sets off quite a controversial problem. The person is involved in the accident is now describing low back pain. We cannot find anything wrong with the patient on more conventional diagnostic tests such as MRI. The insurance companies do not understand why a 25 mph auto accident could cause ongoing pain as you are describing. Worse, you start going to healthcare providers who are not trained and equipped in making such a diagnosis and you start racking up medical bills for treatment that is completely ineffective. Medical bills are now mounting and the patient does not have any objective evidence of an abnormality.

Annular tears can extend all the way to the outer fibers of the disc as seen in in the picture above. The annular tears can communicate to the internal disc. The proteins of the nucleus are foreign to your body and when they leak to the outside of the disc space it can set off an autoimmune reaction and inflammation. There are also chemicals within the disc that also can leak from the disc to surrounding tissues specifically around the nerves that can sensitize them and cause pain.[4-6] These chemicals leaking from the annular tear of the disc can cause congestion and inflammation of nerve roots and mimic sciatica similar to that which can be experienced with a herniated disc.[7]

The problem with this is that if a MRI is obtained with this type of disc problem it may be read as normal. It may show some age related degeneration of the disc which is also normal. So here you are with low back pain seeking care from physicians and they tell you that the CT scan was normal, x- rays are normal and there is only mild degeneration of the discs on MRI also normal. The patient is often told that there is "nothing objective" that can be seen wrong with them or there is no "objective evidence" to support their current complaints of back and peripheral leg pain. One can only imagine how devastating that must feel to a patient who may be desperately seeking help and a resolution to the problem.

There is a test called a "discogram" shown to the right that can be used when indicated to visualize these tears and confirm the diagnosis. This is discussed in detail in my article on discography which you can find on our website. There are 2 types of discograms. There is provocation discography which involves injecting the contrast into the disc and taking specific pressure measurements in the disc taking caution not to go over a certain amount of pounds per square tenths of pressure. If contrast flows through the disc and leaks into an annular tear as shown in the picture above and also replicates the exact pain that you typically experience this is considered a positive "provocational discography". Another type of discography that we have started using over the last 2 years is analgesic discography. This is a process whereby a catheter is placed within the disc similar to what was done above except this time rather than pressurizing the disc and stimulating pain and anesthetic injection is performed and we determine whether or not you obtained pain relief. I have a complete article on this website on the topic of analgesic discography for your review if you are interested in further reading about this diagnostic procedure.

Do Doctors Understand the Annular Fissure?

Not only do most doctors not understand this most important condition of the lumbar spine, but some radiologists that are reading the MRI studies may not realize the importance of the annular fissure. There

was an era in radiology where most radiologists would ignore this finding all together. Today it is much more common for a radiologist to identify these and list the finding of an annular fissure on an MRI report. Most radiologist are now very much aware of the manner in which these manifest on the MRI image and will usually discuss this finding in their report. The importance of such a finding still will need to be clinically coordinated with your problem.

Unfortunately just because such a finding is present on the MRI does not necessarily mean that it is a significant finding. There have been some researchers that have shown that when a fissure is seen on the MRI there is a strong correlation with a tear that is painful. This was correlated with a confirmatory test called a discogram as discussed above.[8-10] Others are not so convinced of this correlation.[11,12] We will cover the controversies of MRI and annular tears in the later section of this article. The truth of the matter is that whenever findings are identified on the MRI it must be accompanied by a detailed examination and the findings correlated with the findings on MRI. There are specific examination procedures that can be utilized to correlate the findings on MRI to help us determine whether or not asymptomatic annular tear is present or not. We typically do not have to do discograms very often in order to sort this out. This is further discussed in our article on spinal discography.

Many physicians often diagnose a patient with an annular tear as a “lumbosacral strain”. Because the annular tear can cause significant spasm and pain along the muscles of the lumbar spine and therefore often mistaken as a strain to the muscles of the back. Such could not be further from the truth. It is important to understand that the annulus of the disc causes much more muscle spasm and muscle pain than an actual strain of the muscle. So if a physician is unaware of how to make the diagnosis of this condition they will make the incorrect assumption and misdiagnose the problem.

The annular tear or fissure is also one of the most misunderstood conditions amongst manipulative therapy practitioners such as chiropractors and osteopaths as well. Now that is not all of them but as a consumer of healthcare services you will commonly encounter them.

Because their focus is often primarily on joint dysfunction and the soft tissues around the spine their focus can be skewed to fit their “model” of back pain. They often miss this most important condition in their evaluation. To add to the problem and the difficulty in making the diagnosis, these annular tears and fissures mimic so many of the other joint dysfunctions that they commonly treating the wrong source of pain which further complicates the problem.

For example, the annular fissure will often mimic a problem that may suggest the pain is coming from the facet joints or may mimic chronic sacroiliac joint dysfunction. The practitioner may not realize the true source of the pain because their focus, training and unfortunately even “beliefs” about what causes back pain may bring them to such a conclusion. I can speak with some authority about that since I was a chiropractor prior to attending medical school and can attest to the fact that the disc is a predominant source of back pain and annular tears were not taught in chiropractic College when I attended in the 1980s. Although it is more recognized by chiropractors today it is still a huge void in her training. Other manual therapy disciplines are fact well trained to recognized this condition and will be able to sort the diagnosis out quicker than even medical specialists without the high tech diagnostic tools at her disposal. It is therefore important for you to understand the great disparity and differences amongst various health care practitioners and their understanding of this condition. These practitioners come from a specific “school of thought” taught by physical therapist by the name of Robin McKenzie, RPT New Zealand.

One of the difficulties with making a diagnosis amongst doctors is that the disc has referred pain in patterns similar to the other ligaments, muscles, and joints of the spine. For example, the L4-L5 annular tear radiates its pain directly over the sacroiliac joint and extends down the buttock to the posterolateral thigh as seen in to the right. This will mimic sacroiliac joint pain. These patients will experience intense pain directly over the sacroiliac joint. Interesting enough they will also be very tender to touch directly over the sacroiliac joint which can further confound the problem. Now you have pain and tenderness over a region where the pain is not even coming from. The picture to the right is a typical pain pattern referred from the L4-L5 disc. The region and read is the area where the pain is most intense.

This has taken me years of personal experience to sort out. I performed thousands of sacroiliac joint

injections on patients that I thought were presenting with sacroiliac joint pain. After injecting local anesthetics into the joint I was surprised to discover that these patients did not experience any symptomatic relief. Perplexed by this, we then performed a discogram on these patients and found that all too often the pain was coming from a L4-L5 disc. When the discogram was done their pain was specifically replicated over the sacroiliac joint. Or, when analgesic discography is performed to experience immediate relief of pain while the anesthetic as working.

In my early years of clinical practice I was not sure whether this was a "fluke" or whether I had stumbled onto a problem that I had been misdiagnosing for years. I have spoken to many physicians over the years that subspecialize in advanced diagnostic procedures for spine pain patients and they too have discovered the same thing. Today there are many specialty trained physicians who are very much aware of this phenomenon. There are other conditions that mimic sacroiliac joint pain but that will not be covered in this article. I personally coined the term "pseudo-sacroiliac syndrome" in the 1990s as I began to learn how to differentiate patients with disc pain simulating sacroiliac pain from those who truly had sacroiliac joint dysfunction.

Pain from annular tears in the disc can masquerade as other low back pain syndromes. If the tear occurs at the L5-S1 disc the pain referral pattern is different than the L4-L5 disc. The pattern will also vary depending on where the tear is. The L5-S1 disc radiates its pain into the lower "small of the back" centrally which radiates over the belt line. The pain from the L5- S1 disc can also refer pain directly over the center of the buttocks or sacrum and can look like just about everything that a manipulative therapist sees in practice, i.e., facet syndrome, sacroiliac syndrome, etc. So once again we have a disc that is masquerading as something else. The picture to the right demonstrates various pain patterns that can occur from the L5-S1 disc. Some patient may also experience pain overlying the outer hip joint. There are many things that can do this but the disc is one of
them.

So what happens to these patients? It depends on the healthcare practitioner and their models, training and experience. I hope you can see that you could spend a significant amount of time and money seeking care for something that is eluding the practitioner.

Annular fissures also occur in the cervical spine. This condition is not as common in the cervical spine as it is in the lumbar spine. Nevertheless it can in fact be a source of chronic neck pain. In the cervical spine it is often more difficult even for the best of practitioners to differentiate neck pain of disc origin from other sources such as from the facet joints by physical examination without more advanced diagnostic injection procedures.

The annular fissure in the cervical disc is also a masquerader of many clinical entities as well confounding diagnosis and management. For example it is common for the lower cervical discs to refer not only pain but also refer tenderness between the shoulder blades. These patients will have very tender muscles in the neck and across the shoulders mimicking many myofascial syndromes. They will also experience tenderness between the shoulders blades and tenderness over the ribs in the mid back. I have seen patients undergo numerous trigger injections, physical therapy and chiropractic treatment procedures for pain between the scapula only to later find out the pain was discogenic. Despite the well-intended efforts of these providers at best only provide a period of transient relief from treatment.

The patient depicted in the MRI to the right is a patient I saw many years ago for chronic neck pain and upper thoracic pain. She had chronic neck pain and midback pain for years. She had failed most methods of conservative care. She was seeing a chiropractor once per day and sometimes twice per day. She would plan her day around her chiropractic visits in order to keep her symptoms under control. Was the chiropractic treatment helping her? It was certainly her perception that it was. It was the only thing that she had found to get her out of acute pain when she would experience an acute flair. However, she would see the provider many times during the week. She had done this for years! What do you think that small white area is on the MRI? It is a high intensity zone that indicates an annular fissure is present. This was later confirmed to be contributing to her chronic pain.

Sharing that story is getting ahead of myself but I can tell you she had excellent outcome once we

determined the cause. You see she had significant multilevel segmental instability in the cervical spine. It was not just an annuluar fissure that was at the heart of her particular problem but a complex syndrome of multilevel instability with all of its associated soft tissue pain syndromes. In this patients case we utilized a technique of injections called “prolotherapy” which is described in detail in another article on the web site. Because she had too many levels of segmental pain we did not want to see her go through a multiple level fusion surgery. She in fact refused an offer for surgery. After about a dozen injection series directed to the ligaments of the cervical and upper thoracic spine she has had almost a complete resolution of her pain. She now sees the chiropractor in her community only on rare occasions. I see her maybe once every two years for a booster injection and she has her life back. He husband was also most grateful as well. This treatment did not address the annular fissure directly. In this particular case we approached a myriad of problems she was experiencing by stabilizing the cervical spine with these injections. This seemed to provide enough relief we were able to avoid surgery. There are reasons why stabilizing the joints of the neck resulted in pain relief. That is not addressed in this article.

Unfortunately annular fissures and disc pain can also occur in the thoracic spine as well. When they occur in the thoracic spine they also mimic many syndromes similar to the cervical and lumbar discs have. I can still to this day recall my first encounter of a patient with an annular fissure or tear in the thoracic spine, or at least the first one that I recognized. She was the wife of a prominent attorney in our community. She has been involved in a motor vehicle accident. She developed significant mid back pain. Interesting enough the majority of her pain was not isolated to the thoracic spine but rather she had pain overlying the muscles overlying the ribs of the mid- back and along the muscles of the mid back. She had failed a long course of physical therapy. In my early ignorance I directed her through more comprehensive care. She failed everything we tried including facet injections, PT, manipulation, medications, exercise, etc. Her x-rays were of course normal and her MRI was completely normal. Just what was wrong with this individual? Was she just going on about pain for personal gain? After all, she was the wife of an attorney.

Could her knowledge of the medical and legal system be allowing her to fool so many clinicians? I ordered a discogram on this patient and as you may have well guessed she had a tear in the disc that was the source of her pain. Finding the source of the pain was to eventually lead us to utilize a much different treatment approach.

So now you know why I call the annular tear the great masquerader. The annular tear and fissure can masquerade as a back pain strain, as a facet syndrome, sacroiliac syndrome, sciatica or herniated disc, and a number of other muscular and myofascial conditions that are so common in the musculoskeletal practice. Annular fissures can cause neck pain, mid-back pain, low back pain and can radiate pain into the arms or legs. An annular tear in one or two discs plus a few aches and pains from soft tissues such as ligaments and muscles can create diffuse pain that can look just like someone with “fibromyalgia.” Chiropractors and osteopaths that use manual therapy can see these conditions only to be frustrated when treatment fails. Prescription of exercise, and physical therapy may not provide significant symptomatic relief of pain either. Having the right diagnosis saves a lot of time and money and allows us to focus on the pathology before we intervene.

Do These Annular Tears Show Up On the MRI? This is a very complicated question. I have already addressed that in fact annular tears can in fact be seen on MRI. This is a topic of both clinical interest and controversy.

Before we go any further with this discussion let us look at how a disc attempts to heal when an annular tear is present and just what an MRI is capable of picking up when performed on a patient with such a condition. Remember I told you that the disc has a very poor blood supply.
Although the majority of the disc does not even have a blood supply there are small capillaries that do supply the very outer portion of the annular rings.

When the disc is torn the annular fissure can progress to the periphery of the disc as shown in the picture on the right. The body will indeed attempt and to try and heal such a tear in the disc. As the disc attempts to heal, it will do so by forming a fibrous scar over the surface of the tear. In an attempt to heal the tear small capillaries and blood vessels begin to form and migrate into the tear. This proliferation of blood vessels in the annulus of the disc causes the formation of small vascular “buds” that protrude into the tear

of the disc. This is shown in picture below. Once there are small vascular buds pushing into the annulus the MRI can pick this up. In other words it is basically the disc's attempt to heal that really is what is picked up on the MRI. It is not the tear but the vascular buds that are attempting to heal the tear that are actually seen. This phenomenon causes a "white spots" or a signal on the MRI at the radiologist called a "high intensity zone" that suggests the presents of an annular fissure.

There is a special sequence of pictures taken on the MRI called a T2 weighted images. The technical aspects of MRI and that sequence are not important to our discussion. What is important is that these special MRI sequence are very sensitive to water or fluid density. Even the slightest fluid concentration change can be detected on the MRI. This is how we can visualize a small tear in the cartilage of the knee for example. It is also how we visualize these tears in the annulus on MRI. Remember that a budding blood vessel has blood or fluid in the bud. This fluid will signal as a white spot on these MRI sequences.

The annular tear or fissure is shown in MRI noted to the right as a small white "blip" at the back of the disc. Take a close look at the disc with the arrow. Look at the disc above that region. Notice the small white dot is not present in the disc above. The white dot is that annular fissure. The disc above has no visible annular fissure.

Notice in the previous MRI that the disc with the fissure is darker than the disc above it. It is darker because it has less water held within the disc. Basically it has become dehydrated due to the internal changes within the disc due to degenerative disc disease. As we have stated above, once the fissure reaches the external annulus there is an attempt to the body to try to heal this. Small vascular buds begin to try to grow into the area in an attempt to try to heal this lesion, but0 the healing is usually incomplete. The MRI sensitive to water concentrations will pick up these little vascular changes and will be seen as a *high intensity zone* or HIZ which means a fissure is present.

There has been a great deal of controversy over the importance of discovering an annular fissure on the MRI. Lam and his colleges looked at 92 discs with noted HIZ phenomena on MRI (remember that is an annular fissure). They performed confirmatory testing on these patients and concluded that there was in fact a significant correlation between abnormal disc morphology and the HIZ noted on the MRI. They went on to indicate that the nature of the HIZ remains unknown, but it may represent an area of secondary inflammation as a result of an annular tear. They concluded from this study that the lumbar disc HIZ observed on MRI in patients with low back pain is likely to represent painful internal disc disruption.[9] One of the first articles that got my attention on this subject was by Aprill and Bogduk both individuals whom I hold in high regard. They described an 86% incidence of concordantly painful discs in patients with low back pain that exhibited a high-intensity zone on MRI. They assert that the high-intensity zone is a reliable marker of discogenic pain in symptomatic subjects. They also found this to occur in 28% of 500 low back patients undergoing MRI.[8] Shortly after professor Bogduk published his findings on the subject another group of researchers repeated this study to see if they could identify similar finding. This was done by Saifuddin, Braithwaite and colleges. They found that the high intensity zone on MRI correlated 87% of the time. They concluded that in patients with symptomatic low back pain, the high-intensity zone is a reliable marker of painful outer anular disruption. In the early years of MRI I too look very closely at this finding and felt it also correlated relatively well in our clinical practice.

Many researchers however did not agree that the findings on MRI correlated as well as some of the early researchers had published. Some were not convinced of the importance of the high- intensity zone finding on MRI. Rankine et al noted only a 45% correlation.[13] They indicated the presence of a high-intensity zone does not define a group of patients with particular clinical features.[13] They are not alone, Ito and his colleges also indicated the presence of these tears were not a reliable predictor of a painful disc on discography. They concluded that although the lumbar intervertebral discs with posterior combined annular tears are likely to produce pain, the validity of these signs for predicting discogenic lumbar pain is limited. They did note that the HIZ on MRI is a relatively reliable predictor of pain but they related that the statistical values were lower than those in previous studies.[14] Today we have to correlate clinically the importance of this finding to sort out if a fissure is important or not in a given patient.

The MRI of the disc loses its signal intensity as the disc degenerates. On the T2 image previously discussed the degenerated disc gets darker. As the disc gets darker on the MRI one may also see a

decrease in the disc height as the disc becomes further degenerated and breaks down internally. The loss of intervertebral height and/or abnormal signal intensity on magnetic resonance imaging has been shown to be associated with disc disruptions extending into or beyond the outer anulus on discograms. One can differentiate lumbar disc protrusions, disc bulges, and discs with normal contour but abnormal signal intensity.[15] Other researchers have also noted that the more degenerated a disc is the more likely it is to be responsible for pain. However, no abnormal lumbar disc signal pattern could be identified that specifically indicated whether a disc would be painful. They concluded that discography is still the only method for symptomatic assessment in low-back pain.[16] What I am saying is that one cannot rely completely on a MRI to make a determination as to where your pain is coming from. That is a very important concept. The other important thing I want to point out is the fact that a patient can have no visualized abnormality at all on MRI and still have a symptomatic tear in the disc.[17,18]

We will address this issue further when we discuss the use of discography. The next time you or a friend or loved one is setting in a physician's office and the physician comes in and reports "your MRI is normal there is not a thing wrong with you", you may be in the wrong place. You can also have the opposite thing occur. You can have a doctor will state to a patient that a small bulge on a disc or a fissure noted on an MRI is the cause of all their pain. The findings may not even be important! Let me repeat the message here. You cannot rely on the MRI as the sole method of determining where the source of you pain is! The MRI is just one piece of the whole clinical puzzle.

How is the Annular Fissure or Tear Diagnosed?
Making the diagnosis of a painful annular fissure is done by some sophisticated medical detective work. The diagnosis of the annular fissure is done both clinically and by combining sophisticated imaging techniques for confirmation. The clinical suspicion that an annular tear is presently reached by combining a thorough history of the problem and a detailed look at the way in which certain activities, movements and postural positioning effect your pain. It is also helpful to do a careful assessment of how your pain responds to specific movements of your spine carried out to the end of the range of motion. A well-seasoned clinician who is experienced in evaluating discogenic pain patients can usually predict what will be seen on the MRI and discogram by just doing a thorough history and performing a comprehensive examination. This exam would include observing the symptomatic response to these repeated end range motion of the spine that we have previously eluded to. In fact, it has been shown that well-trained clinicians can be amazingly accurate with these predictions and has shown that they are able to predict with uncanny accuracy the findings that would be present on discography.[19] This specialized technique of the examination was popularized in New Zealand by physical therapist Robin McKenzie.[20] We call this method of examination the "McKenzie exam" named after him. I have modified this technique over the years which has become a foundational examination procedure that I have used in conjunction with other physical examination techniques and MRI review to evaluate patient's with possible discogenic back pain. If a healthcare provider is trained to clinically evaluate a patient in this manner, not only will the provider be able to tell you whether or not you have an annular tear but he or she may be able to tell you the extent, size and position of the defect or tear in the disc based on the physical exam.[21] Unfortunately most physicians are not trained nor understand how to use this system for evaluation of patients with back pain.

The MRI is only a tool in the process of making a diagnosis. It has to be used as a helpful tool and not to be used as a definitive diagnostic tool to determine whether there is a problem with your back. You will commonly read a term on the radiology report that indicates that some of your discs are "dessicated". As a disc undergoes degeneration it looses the ability to hold as much water in the disc. The disc becomes, I guess you can, say dryer and therefore looks darker on a specific MRI sequence. The loss of water within the disc or dehydration within the disc is called "*dessication"*. Remember that it is entirely possible that the MRI will not explain the cause of your pain. Just because there is a disc bulge, a dessicated disc or any degree of degenerative pathology of the disc does not necessarily mean that this specific level where an abnormality is seen is the source of your pain. I cannot tell you how many people begin the intake history by telling me I have 3 bulging discs, etc. etc. People wear these diagnoses of disc bulge like a "badge of honor". They cling to the diagnosis made by the MRI when really it means nothing!

Medical providers also misuse the MRI finding as well. It is not uncommon to have a patient tell me that they consulted a medical specialist and they throw up the MRI and state there is "absolutely nothing wrong with your back." What they should say is that the MRI does not explain the cause of your pain. Of course

there may be an occasional individual who is utilizing a simple bulge or finding on MRI to fake a condition or injury for personal gain. This is rare but is an unfortunate reality in our society which I have seen clinically for years. We have our ways of sorting this out as well.

So, if the MRI is not a “gold standard” for disc pain diagnosis what is? There is a technique called "provocation on discography" that is occasionally used to make the diagnosis of discogenic pain or a painful annular tear. This technique is not without its controversies as well which will not be addressed in the context of this article but is addressed in the article on discography.

Basically a patient who undergoes discography goes into a surgical fluoroscopy suite and a needle or catheter is inserted into the disc and a contrast is injected into the disc. This process stimulates pain that can replicate your typical symptoms and also is a means to visualize the tear or defect in your disc. I prefer to use discography sparingly and there are many reasons for that. I believe that one can sort out whether or not an individual has pain from the disc and many other ways without going to such an invasive procedure. I have also previously mentioned that we also perform “ analgesic discography” where instead of pressurizing the disc and trying to cause pain we injected analgesic in the disc and try to relieve the pain.

If the physical assessment using a modified McKenzie examination is not able to make the diagnosis then one can use fluoroscopy controlled diagnostic blocks to rule out other causes of pain. A fluoroscopy unit is a specialized x-ray machine shown to the bellow. It can be used by a trained medical specialist to do precision guided diagnostic and therapeutic injections. By using these diagnostic blocks one can help sort out the causes of spine pain that can help us make a much more accurate diagnosis and determine the source of the pain. Only rarely do we have to use discography.

I feel strongly that the use of discography is very important as a diagnostic tool when one cannot find another source of pain. The reasons we use this technique sparingly is discussed in our article on discography. Although the discogram has been considered the gold standard in making the diagnosis of painful annular tear typically we can sort this out by using the means previously described.

The vibration sensitivity test, a low tech method of determining internal disc pain.
There have been a number of spine specialist and surgeons that carry a rather simple tool around with them in order to test for possible presence painful lumbar discs. What tool is this you ask? None other than a simple vibrator. There have been several studies that have shown a good correlation between pain that can be stimulated when a good strong vibrating tool is applied to the spine at each level. When placing the vibrating tool onto the back of each vertebra and pain is stimulated it has been found to correlate to the findings noted on discography.[22,23] This is just one more simple tool in addition to other physical examination techniques and history that can lead one to determining a possible painful lumbar disc.[21]

What Is the difference between a disc derangement and an annular tear?
In a previous article we described a phenomenon called the internal disc derangement. I refer you to that article to describe the phenomena of internal disc derangement. In brevity a disc derangement, occurs when a portion nuclear material moves into a weakened area or a tear in the disc and the nuclear material becomes entrapped causing severe back pain. The derangement represents an entrapped nuclear fragment in a tear or zone of the annular wall. This often results in a tilted (antalgic) posture. This entrapment is usually reducible and can be moved out of this defect and thereby relieve some if not all of an individual’s pain. Some patients that experience such an episode can then remain completely asymptomatic for months or even years between episodes. A patient with an internal disc deragement may or may not have a positive discogram. That is a very important distinction between the annular tear patient and the internal disc derangement patient.

In the case of the annular tear or fissure patient, the tear extends into the periphery of the disc as seen in the picture to the right. The tear can also communicate externally and leak also shown to the right. When an annular tear has extended to the outer annulus it can stimulate the region of the disc most sensitive to pressure and pain. If one were to inject a contrast material under pressure in this disc the solution injected into the disc will travel right through the tear and exert pressure on the outer fibers of the annulus or leak out of the tear when the test is performed. In addition this will stimulate or replicate the usual pain the

individual has been experiencing. That is what discography is.

Remember that a derangement is often the beginning of a disc disease cascade. Many patients with a history of periodic derangements can eventually progress to a tear. An individual may have no history of derangement and experience a tear with a lifting incident or injury. Many annular tear patients may not experience the same locking sensations that the derangement patient has and typically is not noted to have the "antalgic" position that is so common in the derangement patient. A patient may have both. They may have an annular tear that causes a dull constant pain that increase with activity and they could also experience periodic acute episodes of pain with associated antalgic posture when a portion of the nucleus shifts within the disc becomes trapped in the tear.

Technically speaking a patient who has periodic acute pain from a disc derangement has an annular tear of fissure. But the tear is in the internal sections of the annular rings it not cause continuous pain like the annular fissure patient. The reason for this has already been reviewed.

One would think that once the disc becomes so dehydrated with extensive degeneration that there would be no way they could have episodes of acute pain with the associated shifted posture so common to the internal disc derangement. However this is not the case. I have seen many patients with significant degenerative disc disease still have these derangement episodes. How could this be? Even in some discs that have undergone significant degeneration and “dehydration” there can still be left over fragments of hydrated nucleus in the middle that can move around. If this piece of viable nucleus shifts along the fissures of the disc it can get trapped and you have acute pain simulating a derangement. There are other times disc dehydration and degeneration is you friend! You could have a history of these derangements for years and then as the disc dehydrates it stiffens. When this occurs the nucleus no longer mobile within the disc and will not shift positions in the disc. Once this occurs, from that point on you may have very little problems with you back! I have discussed this theory with my colleges for years. Many of which doubted this mechanism of back pain. Once they started using the new fiberobtic scopes and laser procedures they have identified these viable fragments of nucleus within a degenerated disc exactly as described. Laser ablation of the fragment resolved the patients pain! Remember this is not the case with everyone and it takes a physician acting as a medical detective to sort this out.

Types of annular tears and fissures:
There are a number of different types of annular disruptions or tears. The tear can begin on the outside and work its way to the center of the disc. The tear can also occur in a circumferential fashion better known as a "rim tear". The rim tear represents a separation of the annular rings along the outer portion of the disc. There was a time when we did not think that these types of tears actually caused significant pain. As we have improved our discogram techniques we have found that these rim tears can cause pain. With some rim tears both the MRI and the standard discogram may be normal! This lesion may not show up as the source of pain unless one does an annulogram rather than a discogram. (Please review the discogram article for a more detailed discussion of discography and the techniques used in this procedure).

Another type of tear is when the annular fibers begin to tear from the inside of the disc near the nucleus and then progress out to the periphery of the disc. There are two types or sets of rings in the annulus. The inner set of rings are more cartilage like. These inner cartilaginous rings are responsible for containing the nucleus and withstanding significant compression loads applied to the disc. The outer set of rings of the disc is more fibrous in nature. These rings are set up in layers like the plies of a “radial tire”. It is these fibrous rings that are quite pain sensitive with a rich nerve supply. Most tears in the disc begin by a break in the cartilaginous inner annulus and then allow the nucleus to tease its way through this tear. This tear will then open and propagate itself into the outer annulus to eventually communicate to the outside of the disc. As we have already stated in the presence of a full tear to the periphery or outside rings the disc substances can leak outside the disc. These substances can cause inflammation of the nerve close by. This is a very important concept. It is the basis of why so many people can be benefited by epidural steroid injections.

These annular tears can “reak havoc” by leaking inflammatory substances out of the tear. This causes the tissues exposed to the effects of these chemicals to be quite sensitized to pain. Even structures that are not usually that pain sensitive will become mechanically sensitive. Sometimes can cause long standing

inflammation and can cause fibrosis around nerves and the formation of a inflammatory membrane that we can see under fiber-optic surgery.

It was the surgeons specializing in endoscopic spinal surgery that first began to notice these inflamed tissues and membranes and to find just how pain sensitive they had become.[24] To visualize these membranes a fiberoptic scope is inserted into the neuroforamen where one can visualize the tissues surrounding the nerve roots and the tissues just behind the disc. These tissues are much harder to observe in an open spinal surgery because of the bleeding etc. This inflammatory membrane has been thought to possibly be another hidden source of chronic pain. If it is not recognized at the time of treatment and teased gently away and ablated many times the pain continues despite the heroic efforts of the doctor trying to help you.[25] The spinal surgeon that is specialized in endoscopic surgery of the spine can remove this inflammatory membrane thereby assisting recovery. This is “tricky business” and the techniques are unfortunately known to few. This is changing however. There has been a significant increase in the number of surgeons being trained in these methods over the last 10 years.

Treatment for Annular Tear or Fissure:
One of the biggest questions that has perplexed healthcare practitioners that treat spine pain patients is "what can we do for disc pain caused by an annular tear or fissure?" This is a huge problem and represents a dilemma in the industry. This is a subject that is a focus of significant disagreement amongst medical specialists. The treatment of discogenic back pain and annular tears is possibly one of the most controversial topics in interventional spine practice today. There are no easy answers to this question. Careful patient selection and evaluation of individual variability and pathology needs to be taken into consideration making this an extremely complexed clinical decision making process. The topic of treatment for discogenic back pain will be covered in multiple articles on this website.

First of all one cannot discuss discogenic back pain without addressing the importance of conservative rehabilitation treatment. Over the years having a manual medicine and rehabilitation medicine background I have implemented countless rehabilitation strategies including various exercise protocols, corrective movements, high tech rehabilitation using computerized assisted exercise machines as well as low tech exercise technology. We have used spine stabilization techniques with gym balls, foam rollers, rocker boards, resisted bands, et cetera. We have utilized McKenzie exercise strategies and categorization procedures all with of course some success. It is critical to have all patients with discogenic back pain develop a strategy of core stabilization and strengthening as a foundational approach to the care of her chronic pain condition. I recommend anyone with discogenic low back pain read my article on “why did physical therapy making worse” which describes neutral spine stabilization protocols that should be utilized to prevent the discogenic back pain patient from worsening with exercise. Anyone with back pain can be put through a protocol to increase the strength and endurance without aggravating the condition. It takes training and very special techniques implemented and customized for each individual clinical presentation to accomplish this.

During my early years in clinical practice I fell into the trap of recommending spinal fusion surgeries to patients with discogenic back pain. After seeing countless treatment failures I began a 26 year journey traveling around the world looking for technological answers to the treatment of discogenic back pain. It led me to participate in multiple fellowship training programs. It led me to leave my clinical practice in manual medicine and go back to school on many occasions and eventually leading me to attend medical school, internship, residency, and to participate in not one but two interventional spine fellowship programs. Although I do not have all the answers to this complex question, I have expanded my scope of understanding and capabilities to take advantage of technologies as they arise and to participate in important clinical research to develop new technologies for patients with discogenic pain.

I was fortunate to have practiced with David Salinger,
M.D. in Los Gatos California who was one of the first interventional spine practitioners in the US to begin utilizing radiofrequency nucleoplasty and radiofrequency annuloplasty. After having visited a physician in the Netherlands who originated the idea Dr. Salinger was the first that I know to understand how to systematically use this technology for the treatment of annular tears. We did this for years before it sparked interest in other spine specialist throughout the world. In the early 1990s we introduced a technique whereby a radiofrequency probe was inserted under fluoroscopy into the nucleus and thermal energy was

utilized to coagulate the nucleus and alter its mechanical behavior. In addition we would place the probe near the periphery of the disc where thermal energy from the radiofrequency probe would coagulate the proteins of the annulus fibrosus thereby shrinking them and theoretically sealing or altering the mechanical behavior at the tear in the disc. We described this technique in 1997 in a newsletter of the International Spinal Injection Society.[26]

We enjoyed significant success with this technology. Having a personal interest in physical assessment, categorization procedures, biomechanics and manual medicine I quickly began to realize that we could utilize specific criteria to better selected patients for these procedures. It was Dr. Salinger's original work in this area that was the start of the intradiscal technologies that have proliferated over the course of the last 20 years. The radiofrequency that we used in the early 1990s was a basic modification of radiofrequency techniques that have been around for years. We just modified the probes. Radiofrequency had previously been used to denervate the nerves from the facet joints. The details of that procedure are discussed in another article. We simply began inserting the radiofrequency probe into the disc. The radiofrequency probe works similar to a microwave which results in a thermal effect. Just like the microwave the more water is contained within a structure the more efficient the thermal effect. We began to learn very quickly that the dryer or more desiccated or degenerated the disc was the less efficient radiofrequency was in treatment. Many patients with substantial disruptions within the disc (internal disc disruption) may have significant symptomatic relief when treating the annulus and thermally shrinking the annulus to affect the mechanical behavior of the disc. Unfortunately with advanced degenerative changes many times the results were not long lasting and symptoms could return within a few years.

Early pioneers in the Netherlands used to insert the radiofrequency probe into the disc in an attempt to thermally heat the entire disc and annulus. The purpose of this was they felt that there may be a denervation or a "killing" of the nerves in the disc. Later this was found not to be the case at all.[27] In fact, there is no destruction of the nerve around the periphery of the disc that occurs with this treatment whatsoever. In the early years of utilizing this technology we began to realize that the thermal lesioning was affecting collagen protein and coagulating these proteins causing a "shrinking effect".[26] This collagen protein “shrinking” was secondary to a denaturing effect on the proteins similar to the effect of heat has when frying an egg white. These pioneering physicians began to realize and ultimately prove that using radiofrequecy no matter where you placed it into the disc was not killing the nerves at all. Something else was happening. What was occurring was a cauterization or a burning of the disc that was stimulating a shrinking of tissues at the site of the annular tear. This was due to the denaturation effects of the heat on protiens.

They discovered that this worked much better if the probes were introduced close to the internal tear of the disc or at least as near the tear zone as possible. It was at this location that the radiofrequency stimulation or heating stimulation could have a more direct effect on the weakest part of the disc. This resulted in a new modality of treatment that began to provide great promise for the annular tear or fissure patient.

This was to be only the beginning and soon two other technologies soon was introduced after they became aware of what we were doing with this technology. The first was IDET which I will describe later. The second was Coblation nucleoplasty introduced by ArthroCare.

ArthroCare began in California very near our facility. They contacted Dr. Salinger in whom I worked for at the time to assist him in their early development of the techniques utilizing this new technology. They introduced a means of vaporizing tissue utilizing radiofrequency energy at the tip of the needle. The needle probe is introduced into the disc as shown on the picture to the right. The needle is pushed through the disc with several passes. Each pass ablates or vaporizes a track within the nucleus removing the nucleus as the needle probe is pushed through the disc. During withdrawal a radiofrequency thermal energy is applied to cause a shrinking effect. With several passes of ablation followed by coagulation the theory was that you could remove a portion of the nucleus and reduce the pressure within the disc thereby altering discogenic pain. We were the first to conduct a clinical trial using this technique. We presented our results in a conference in San Francisco and I expressed my concern at that time that we did not know what the effect of this technology had on the internal disc and internal disc movement dynamics. We did have preliminary success. It is my personal opinion that although this technology is unique but it is not a technology that I believe is helpful in most patients with discogenic back pain. Later one of my mentors and

colleagues at the University of Washington did coblation studies on fresh cadaver discs only to find that the internal disc was being fragmented by this technique.

In 2009 one of my colleagues and mentors published a systematic review of this technology.[28] Their conclusion was that there may be some evidence for its use with patients with leg pain from a disc bulge but there was no evidence that it was effective for treating back pain. This was my conclusion long before this study was published.

Percutaneous lasers have also been utilized for both treatment of back pain caused by annular tears as well as contained disc protrusions causing leg pain.[29] Percutaneous laser technology does offer some benefit to some patients fitting specific criteria. The problem with this technology is whether or not patients can benefit long-term and not just for 2-3 years. Typically this technology is used for contained disc protrusions. There are some new techniques utilizing laser that is used to treat the disc introduced through the epidural space from a fiberoptic camera (epiduroscopy). We have little outcome data on this new technique and I have no opinion in regard to whether this technique will offer any advancements in spine medicine in the future.

Another technique that is commonly used in Europe but rarely used in the US is the utilization of oxygen ozone injection in the intervertebral disc. This technique is so unique and so interesting that I will devote an entire article on this subject for comprehensive review. To be brief oxygen ozone is basically O3. Normally oxygen or O2 is stable with a bond to oxygen molecules. Ozone is generated when pure oxygen is exposed to a high energy field where molecules are excited and an oxygen molecules will jump orbit and combined with an O2 to become 03. This is a very unstable chemical state. When 03 is injected into the disc and oxygen singlet molecule O- is released as a reactive oxygen species now wants to bond to become stable. When it is injected into the disc it oxidizes the nucleus pulposus proteins causing it to shrink. I personally use this technique and find it to be very promising. It is also one of the more safe intradiscal procedures that we can utilize today. Patients must fit specific criteria but this technique offers great promise.

There have been many modifications to thermal lesioning of the annulus initially done by radiofrequency as we previously described. Another group of physicians working nearby us in Los Gatos California years ago developed intradiscal electrothermal annuloplasty (IDET). Instead of using radiofrequency thermal coagulation of the annulus of the disc they used electrothermal energy. In this procedure a probe was placed within the disc and a circular coil is extended through the disc which coiled back around the tear in the disc. Electrothermal energy is used to coagulate the disc and seal the tear or alter the mechanical behavior of the disc. We performed 100 of these in the 90s and found initially patients did quite a bit better but within a year after the procedure most patients had return of her pain. We eventually discontinued using this procedure. Other minimal invasive spine specialist have tried placing probes into the disc and taking some of the nucleus out of the center of the disc thereby decreasing the internal disc pressure. This is done by a small microscopic agar bit as shown in the magnified picture to the right. This has met with some success but it does not work and all patients with disc pain and this fallen out of favor over the years..

STEM CELL THERAPY FOR DISC DEGENERATION, DISC PAIN AND ANNULAR TEARS:
The use of cellular based therapies for intervertebral disc pain has been a focused interest of our facility for years. We have explored numerous protocols and techniques which have included the use of intradiscal PRP injection, platelet growth factors, proteins and sealants and eventually stem cells. In 1993 convinced that the future of treating degenerative disc disease and disc pain was cellular medicine and growth factors we began research in a veterinarian medicine institute with the use of platelet derived growth factors and platelet concentrates injected into the intervertebral disc in goats. A medical pathologist with the background in platelet physiology and a veterinarian institution was willing to join forces with me to work on this important research. We began to work on thrombin and fibrin glue in combination with platelet concentrates at that time. Back then platelet concentrations in plasma did not carry the name “platelet rich plasma” as it does today. Much to my dismay the project was canceled because of the actions of our pathologist. I have remained convinced that we were on the right track. 20 years later it turns out that I was probably right. I believe the future of degenerative disc disease treatment and the treatment of discogenic back pain lies in othobiologic therapies, scaffolding, and stem cell therapies. Although we may

never be able to eliminate the need for surgery we are certainly going to be able to make a substantial reduction in the number of surgical procedures performed for back pain in the future.

A number of years ago we were injecting PRP (platelet rich plasma) of various concentrations into the intervertebral disc for certain individuals experiencing discogenic pain. Although we have seen benefits from this procedure in selective patients the response to intradiscal PRP injection was inconsistent. We began to explore a number of different stem cell and regenerative intradiscal injection procedures. I began consulting a number of my colleagues around the world utilizing this technology. Over the last several years these techniques have become more refined and we eventually adapted the use of many of these regenerative injection procedures that we currently use today in our practice. We have been working diligently to advance and refined this technology ever since.

Several of our physicians in our affiliated facilities have been utilizing these techniques for years. Experience and refined methods have also been extremely helpful in combining our collective experience and outcomes and understanding how to direct future therapy. There are countless individuals working on research in this area worldwide and developing new technology focused on regeneration of degenerative disc disease. Our experience involves the use of bone marrow derived mesenchymal stem cells, adipose derived mesenchymal stem cells and more recently a newer technique that we will be conducting clinical trials on in 2015. We will be writing a detail article on stem cell therapy in the disc in the near future which will be posted on this website. The number of studies currently underway and the number of studies published on research utilizing stem cell therapy for degenerative disc disease is becoming robust. A few examples include the work of Pettine et al. who evaluated percutaneous injection of autologous bone marrow concentrates cells in lumbar discs for degenerative disc disease. They noted the treatment to provide evidence for safety and feasibility in the nonsurgical treatment of degenerative disc disease with autologous bone marrow concentrates.[30] Bone marrow derived stem cell injections have also shown to reverse the dehydration and dark signal on T2 MRI suggesting a regeneration of the nucleus of the disc.[31] Stem cell and regenerative procedures for the intravertebral disc has begun to get a lot of momentum worldwide and in the USA.[30-45] We have seen organizations in the US utilize bone marrow derived mesenchymal stem cell injections for intravertebral disc disease and they have validated rehydration and regeneration of degenerated discs noted on the right. Other researchers have also documented the restoration of T2 signal intensity on MRI which is typically improved after injection of stem cell and a hyaluronic acid hydrogel.[46]

Several physicians in our organization have been performing bone marrow derived mesenchymal stem cell injections on hundreds of patients and the response has been so promising it has led the rest of us adapting this technique approximately 2 years ago. We then began to utilize other proteins extracted from a patients blood to help seal tears in the disc and eventually we have moved into adipose drive mesenchymal stem cell injections for the intervertebral disc. It has been the latter that is shown the most promise. Adipose derived tissue mesenchymal stem cell intradiscal injections seem to be demonstrating the same powerful anti-inflammatory and immune modulation affects that it when we have seen in other joints. Countless companies are making advances in cell matrix and protein structures that can be injected in the disc and embedded with or used simultaneously with stem cells.

There is a great deal of research being done in this area and we believe that in the near future intradiscal stem cell therapy will be commonplace and utilized in conjunction with these various scaffolding. The critical factor will be being able to implant these substances without damaging the disc. Some of us with our affiliated institutes have gained significant experience in utilizing commercially available aminonic membranes and scaffolding proteins in conjunction with stem cell therapy with excellent outcome. Long-term data still needs to be collected on this however.

We believe that in the near future these “cell matrix substances” in combination with stem cell injection will probably be “the wave of the future”. Although many of these technologies are at various stages of development we are going to see this technology coming to the forefront in the next few years.

Patients undergoing intradiscal injection procedures specifically regenerative injection procedures need to be carefully selected. Many individuals have had progression of the disease that is too far advanced to

undergo this procedure alone and expect good outcome. An example of this would be an individual who has had extensive degenerative changes that has caused growth of bone and hypertrophy of ligamentous tissue around the spinal canal and nerves leading to significant stenosis. There are a number of issues that need to be taken into consideration when considering the specific cellular therapy directed to the intervertebral disc.

WHAT ARE THE RISKS ON INTRADISCAL INJECTION THERAPIES:
Discussing the potential risks of interventional procedures directed towards the disc is just as complicated as the discussion of this entire topic. There are some universal precautions and complications that most physicians discuss doing any interventional procedure involving needles or small probes placed in or around the disc. Before we even discuss the risks of doing intradiscal injection procedures there are potential risks utilizing conscious sedation. These risks can include reaction to medications as well as even cardiovascular collapse and respiratory failure. On most occasions for interventional pain procedures the risk of conscious sedation carries a higher risk than the procedure itself. Although this is extremely rare the potential of respiratory failure and accidental death has been occasionally reported.

Other universal risks involved the potential of nerve injury, spinal cord injury, discitis (infection within the disc), abscess formation which can even occur in the epidural space which can cause further neurologic damage. It is the reason why we have adopted a protocol of injecting antibiotics in the disc and IV inpatients when undergoing intradiscal injection procedures. This provides a substantial reduction in the potential risk of infection based on the work of Dr. Derby one of my mentors.

Anyone undergoing a procedure especially if the procedure is within the disc can make the pain worse! Usually this is temporary but you still have to consider the risk that the pain could get worse and remain worse. Even the process of performing a discogram for the diagnosis of disc disease can make the condition worse. It is because of this that we have adopted numerous changes to our procedures to try to reduce this potential in our practice. This is discussed in our consultations with patients considering these procedures. I refer you to the article on analgesic discography for further discussion on that topic. Some individuals can be allergic to the contrast agent used in discography or during intervertebral disc procedures.

There is a possibility that you can accelerate disc degeneration depending on the size of the catheter or probe placed in the disc and the procedure. I have discussed this in detail in my discussions on discography but I remind the reader that simply placing a needle in the disc can possibly cause disc injury. We base this on work done by Eugene Carragee, MD as described below. Having noted carefully the size of needles that can potentially cause harm of the disc we have adopted the practice of limiting the size of any catheter or needle used within the disc to 25- gauge or less to reduce the potential damage to the disc. In 1997 Dr. Carragee was doing research on discography which I have previously described. As you now understand a discogram involves a needle placed within the disc and contrast is then injected into the disc. This procedure helps determine if a specific disc is symptomatic and allows a physician to properly categorize the type of disc disease that is present. This procedure is not without risk. Carragge and his colleagues followed patients who had undergone discography in 1997 for a period of 7-10 years [47]. He reevaluated these patients at that time with MRI and noted that on the side and site were a large gauge discography needle had been inserted into the disc there was a higher incidence of disc bulge and overall higher incidence of disc degeneration at that segment. This research study altered the behavior and practice paradigm of many pain and interventional spine physicians around the world. We have made many adaptations and changes to our practice and disc procedures based on this research study.

As it pertains to procedures involving radiofrequency energy, thermal ablation, etc. these procedures do accelerate degenerative disc disease. The hope is obviously to improve chronic pain but there is a price. The larger the probe or the larger gage of the needle placed in the disc more damage occurs to the disc based on the research described above.

The risks involving intervertebral disc regeneration procedures are somewhat more complex. Yes you can use small catheters and take any number of precautions but there is more. There is an old saying “today’s answers is tomorrows problem”. Not only are there are questions about what is the safest and most efficacious means for disc regeneration the question is actually should we regenerate a disc? Should we

use regenerative procedures and if so what type of procedures are appropriate for specific disc pathology and when should we use these procedures? Let me give you a few examples. A colleague of mine who is an expert in intradiscal procedures and orthopedic spine regenerative medicine is consulting a woman with degenerative disc disease and a disc bulge. She presents with chronic low back pain and intermittent leg pain. The disc was confirmed to be the source of pain and a stem cell injection was performed within the disc. Her back pain progressively resolved but she began to experience more frequent leg pain. With persistent increased leg pain a repeat MRI was performed. The MRI demonstrates reversal of the dehydration and degeneration of the disc! However, now that the disc is rehydrated it is more hydro-dynamic and the motion of the nucleus of the disc is increased. With the renewed hydrodynamic changes in the disc the disc bulge is actually bigger and she is now going to have to go through a second procedure to reduce the disc bulge. Although this is an unusual problem it does make the point and demonstrate how complex this problem is.

There are other challenges that we face with disc regeneration procedures. Occasionally we fine an individual with a well-hydrated disc that looks very good on MRI but possesses a large annular tear on discography. Regenerative injections seem to increase hydrodynamic pressure within the disc and patients sometimes do not do as well. The focus in these patients is on the annular tear rather than rehydrating a disc which makes the problem worse. We feel that it is very important to classify and characterize lumbar disc syndromes in order to come up with the best strategy.

We use a modified McKenzie classification adopted from a classic physical therapy evaluation in conjunction with correlation of diagnostic imaging, discography and other physical examination and critical facts obtained from the history.

It is also just as important to know when to leave a disc alone. Just a day ago I had a 38-year-old female who had an annular fissure noted on MRI and degenerative changes at the L5-S1 disc.
She has been treated for several years seeing a dozen medical specialists and 2 years of physical therapy, osteopathic manual therapy, etc. She had pain overlying the sacroiliac regions and over the sacrum and lumbosacral spine. She had periodic pain in her hip would radiate into her leg. MRI demonstrated no disc herniation and no nerve root compression. The L4-L5 disc looked relatively normal. During discography it was identified at the L5-S1 disc had become quite fibrous and was not symptomatic. It was actually a stable segment.

The pain turned out to be coming from the L4-L5 disc that appeared normal on the MRI. She had complete symptomatic relief with an L4- L5 intradiscal analgesic injection. The L5-S1 disc is fibrous and has stabilized. Hydrating and regenerating the L5-S1 disc may not be in this patient's best interest. We will focus on the annular tear at L4-L5 and leave her L5-S1 disc alone. Just because you can regenerate a disc doesn't mean you should.

Even platelet rich plasma injections into the disc can improve patients with discogenic back pain. However, one needs to be aware that patients undergoing this injection procedure occasionally experience significant flareups of their pain which can last for weeks and sometimes several months. Although individuals can get better and often do in the long run there have been countless times when we have not proceeded with platelet rich plasma injections into the disc because we knew the individual was not psychologically capable of tolerating increased pain for a period of possibly several months. Regeneration of the disc and regenerative procedures for the disc is a relatively new field and we just simply do not know all of the potential risks, and side effects of disc regeneration procedures. It has taken several years for us to even begin to understand what methods are most effective and when should be use them. This still requires more research and data collection in regards to outcome of these various protocols to better make decisions about specific procedure selection for an individual presentation. It has been fortunate to have a team of physicians around the country with significant experience and well-developed technology and methods for treating lumbar disc disease and doing regenerative disc procedures. Clearly the sum of the whole is greater than sum of the parts and without this important collaboration we would not be as far as we are. It is only through this shared experience that we have improved all of our methods.

IN CONCLUSION:

There are no easy answers to symptomatic annular fissures and discogenic pain treatment. A critical component is to properly categorize the patient so that specific treatment algorithms can be established for consideration of management. This requires an understanding of the patient's history, biomechanics, pathology, and interpretation of diagnostic imaging. This also requires confirmation of the specific pain generators often with diagnostic blocks. Again as previously stated patient selection for any given procedure is critical. After years of experience with multiple intradiscal procedures I can also say that one has to consider cost vs. benefit and risk. One may have excellent outcome initially and an individual ignores recommendations for being cautious and overdoes it and injures their back again. I often tell my patients to take the red cape off. They are not superman and need exercise good judgment at all times. This often requires specific rehabilitation strategy and exercise and movement the patient will need to be trained to do and integrating with physical therapy and rehabilitative services can be important after treatment to prevent reinjury.

Technology, methodology and procedures are in a constant state of flux in the field of regenerative medicine. Problems we have no answer for today we are solving rapidly with time. We have also worked very hard to find a means to keep the cost of intervertebral disc interventions reasonable to allow individuals to gain access to this technology. There are a number of institutions and providers that we feel have made significant contributions to our understanding and technology for intervertebral disc procedures but offer these procedures at exorbitant cost. Reducing cost while at the same time "pushing the pioneering envelope" is a delicate balance.

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