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Chiropractic Research, Education & Fellowship

The "G" Note

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In This Issue

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The Disc

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If there is one thing that sets Dr. Gonstead's work and Gonstead Chiropractors apart from everyone else, it is our focus on and understanding of the disc. While everyone else was calling it a fibrocartilage pad, Dr. Gonstead was flying down to Lincoln College of Chiropractic in Indianapolis to dissect spines and study the disc. In Chapter 5, The Mechanism of Vertebral Subluxation, while discussing the spine Dr. Gonstead wrote, "The *most important of the ligaments are the intervertebral discs*." Nearly the entire chapter is devoted to the disc and its involvement in vertebral subluxation. Since that time the body of knowledge surrounding the disc has grown extensively and all of it supports the theory and findings of Dr. Gonstead and his simple and rudimentary dissection experiments.

Dr. William Kirkaldy-Willis is a name well known to anyone who works with the spine and is considered the pioneer in spinal "degenerative cascade" model which was published in SPINE in 1978 (Kirkaldy-Willis WH, Wedge JH, Yong-Hing K, Reilly J. Pathology and pathogenesis of lumbar spondylosis and stenosis. Spine 1978; 3(4):319–28..). This is a full 8 years after Dr. Gonstead published Chapter 5! Following Dr. Kirkaldy-Willis' paper there was an increase in interest and research into spinal degeneration. This interest continues to this day. Some of the models we can see in use today bear an uncanny resemblance to Dr. Gonstead's model.
Dr. Gonstead's model has 6 categories. Six stages of disc degeneration are listed as follows:

- **DI**—Swollen Disc The entire disc is noticeably thickened and swollen from an acute injury. It is obviously thicker than the other discs in its area of the spine.
- **D2**—Disc Thin at Posterior the space at the posterior of the disc is diminished, with the vertebra just noticeably misaligned posteriorward and inferiorward . The disc condition has proceeded beyond the acute stage.
- **D3**—Disc Very Thin at Posterior the disc is extremely wedged, the body having misaligned very posteriorward and inferiorward. This is a chronic state.
- **D4**—Total Disc is Thin The total disc thickness is observably diminished, and may be reduced to about two-thirds of its original height. The vertebra is misaligned posteriorward and inferiorward. There is minimal damage to the vertebral body above the disc, with some evidence of arthritis or exostosis. This condition has become more chronic than above.
- **D5**—Total Disc Very Thin The total disc is decreased to about one-third of its original thickness. The body has misaligned very posteriorward and inferiorward. There is severe damage to the body of the vertebra above, and well advanced arthritis and exostosis. This is much more chronic and more difficult to correct.
- **D6**—Total Disc Extremely Thin The entire disc spacing is greatly diminished, being from

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two-thirds to totally reduce. The vertebra is extremely posterior and inferior. This is the most chronic, and the most difficult to correct. Figures 103 through 108 show examples of the various stages of disc degeneration in lumbar vertebrae. The cervicals and thoracics exhibit the same degenerative changes.

Recent models that have been put forth include a 5 category model including this diagram.

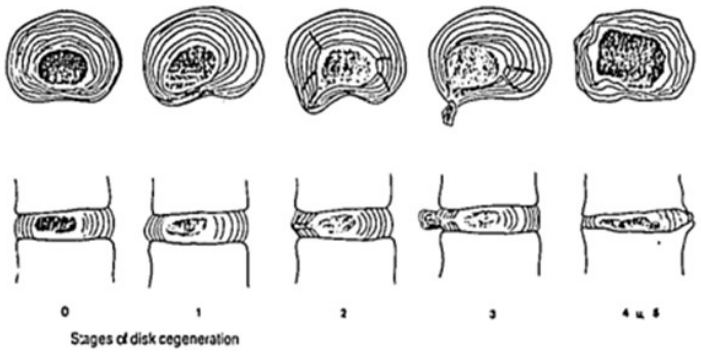

Figure 2. Stages of disc degeneration.

From the Presidential address: Natural Course and Prognosis of Intervertebral Disc Diseases for the International Society for the Study of the Lumbar Spine in 1994. It is interesting to see that they also attribute several ailments to the disc over several decades of life. At 10 and 20 years of life they associate intradiscal mass displacement with torticollis in the C-spine and "Tight hamstring syndrome" in the lumbar spine. At 30 years the disc may have protrusion. In the C spine they state that this causes "Acute local cervical syndrome" and "acute low back pain" in the lumbar spine. At 40 years there is still chance of disc protrusion but not that it causes "acute toot syndrome" in the Cspine and sciatica in the lower back. In the 50s they see collapse of the disc causing chronic cervical syndrome in the neck and chronic lumbar syndrome in the low back. Then in the 60s they saw osseous changes and no clinical symptoms in the neck or low back. Osseous changes continued into the 70s causing chronic root syndrome in the neck and spinal stenosis syndrome in the lumbar spine. Finally in the 80s they found fibrous ankylosis but this caused no change or new symptoms.

I would venture to say that we have all seen quite a bit of variation from this model. Regularly we see people in their 40s and even earlier with osseous changes that they claimed were part of the changes in the 7th decade of life. We also will see 70-80 year olds with little or no degeneration, but not as frequently.

Then in 2001 a new system of grading and classifying disc degeneration was published. Called the *"Pfirrmann method"* after the Principle investigator, this method attempted to use MRI to reinvent what Dr. Gonstead had done over 40 years earlier. In 2007 the Pfirrman method was modified and expanded to eight different classifications of disc degeneration. In the modified version they found *"An 8-level modified grading system for lumbar disc degeneration was developed including a description of the changes expected for each grade and a 24 image reference panel. The reliability of the modified grading system was tested on 260 lumbar intervertebral discs in 52 subjects (26 men, 26 female) with a mean age of 73 years (range, 67– 83 years)."* *"The modified Pfirrmann grading system is useful at discriminating severity of disc degeneration in elderly subjects. The system can be applied with good intra- and inter-observer agreement."* (Modified Pfirrmann Grading System for Lumbar Intervertebral Disc Degeneration SPINE vol 32, No 24, pp E708-E712)

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Table 1. Modified Grading System for Lumbar Disc Degeneration*

Grade	Signal From Nucleus and Inner Fibers of Anulus	Distinction Between Inner and Outer Fibers of Anulus at Posterior Aspect of Disc	Height of Disc
1	Uniformly hyperintense, equal to CSF	Distinct	Normal
2	Hyperintense (>presacral fat and <CSF) ± hypointense intranuclear cleft	Distinct	Normal
3	Hyperintense though <presacral fat	Distinct	Normal
4	Mildly hyperintense (slightly >outer fibers of anulus)	Indistinct	Normal
5	Hypointense (= outer fibers of anulus)	Indistinct	Normal
6	Hypointense	Indistinct	<30% reduction in disc height
7	Hypointense	Indistinct	30%–60% reduction in disc height
8	Hypointense	Indistinct	>60% reduction in disc height

*Grades 1, 2, and 3 are based on the signal intensity of the nucleus and inner fibers of anulus. For Grade 4, the margins between the inner and other fibers of the anulus at the posterior margin of the disc are indistinct. For Grade 5, the disc is uniformly hypointense, although there is no loss of disc space height. For Grades, 6, 7, and 8, there is progressive loss of disc space height. These could be broadly classified as mild, moderate, to severe loss of disc space height. Very occasionally, although obvious disc collapse is present, hyperintense signal from the nucleus and inner fibers of the anulus is preserved. This is referred to by a double entry, *e.g.*, 4/7, with the former reporting the disc signal and the latter the degree of collapse.

Reading through the description, one can easily see Dr. Gonstead's six stages described. This becomes even more obvious when you see the images.

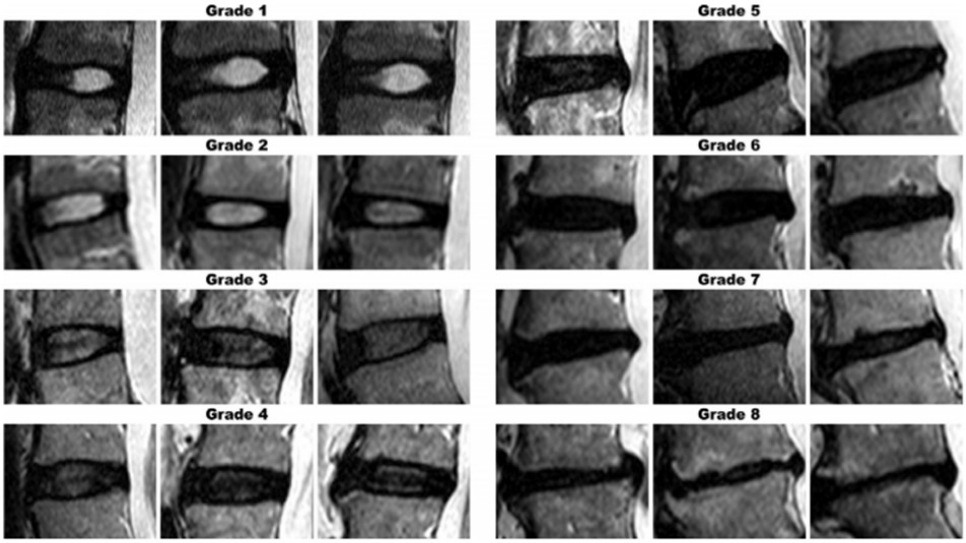

Figure 1. Image reference panel shows increasing severity of disc degeneration. The pertinent features of each grade are described in Table 1. Three images reflect the inherent variability across each grade.

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Left is anterior in all these images. As you can see these models all follow the observations of Dr. Gonstead and offer no real improvement from that model. Since our medical counterparts use these models in their assessments, it behooves us to have a good working knowledge of them so that they come to understand that we have at least as good understanding of the disc if not better than they do. This understanding should go far beyond the basic anatomy and classification of degeneration. It should also extend into the neurology and biochemistry of the disc.

Neurologically the disc is involved in nociception and mechanoreception. The lengths that people have gone to find the sources of pain in the body are almost beyond belief. In 1991 the Orthopedic clinics of North America published an article that stated the following. "In an effort to define the origin of low back pain and sciatica, 193 patients were carefully studied using progressive local anesthesia. These patients had surgery for herniated discs, spinal stenosis, or both. Various tissues were stimulated during the performance of these lumbar spinal operations. This article discusses our observations and the results of that study."

This means that these patients, who were slated for surgery agreed to be experimented on. Using a dull probe their skin was prodded to see if it elicited or provoked their pain. If not, then that layer was anesthetized and cut through to expose the next layer, which was then prodded. This continued, with the patient awake, until the prodding provoked their pain. In all, they tested 22 different tissues: Skin , fat, fascia, supraspinous lig, interspinous lig, spinous process, muscle, lamina, ligamentum flavum, facet capsule, facet synovium, epidural fat, nerve root dura, nerve root compressed, nerve root (uncompressed), annulus (central, centrolateral, lateral), nucleus, vertebral end plate. Their findings were very interesting. Most tissues did not produce any or significant pain without significant force. Muscles produced pain with forceful stretching at the site of blood vessels or nerve attachment or where the muscle attached to the bone, but this was localized muscle pain. Normal nerve roots were completely insensitive to pain. (Read that again). Forceful retractions over extended periods of time resulted in mild paresthesias but never any pain. Compressed nerve roots, on the other hand, consistently reproduced the patient's sciatic pain. The annulus and the end plates were also very likely to reproduce pain. 99% of the time, stimulation elicited pain from the compressed nerve root followed by the central annulus (74%), the central lateral annulus (71%) and the end plate (61%). Paravertebral muscle came in at 41% and the facet capsule was at 30%.

As you can see, Dr. Gonstead was far ahead of his time in his understanding of the importance of the disc. We must remain unmoved in our pursuit of finding the disc that is the primary subluxation and our efforts to correct it. The five tools of the Gonstead system provide the best opportunity for finding the subluxation and helping the patient's expression and quality of life. ♦