

## ***Weight-bearing MRI—As Dr. G would have wanted it!***

*By: Peter T. DeLoe, D.C.*

*Pittsford, NY*

*(From the June 2016 The “G”Note)*

In addition to being the greatest chiropractor, there's no question that Dr. Gonstead was one of the greatest chiropractic innovators and pioneers. His interest in any and all instruments to aid his knowledge and detection of, the subluxation complex, was deep indeed. If someone was going to list the greatest diagnostic tools of the last 100 years, certainly Magnetic Resonance Imaging would garner great support. I am certain Dr. Gonstead would have had one in his office if he were alive today. I'm also certain that Dr. Gonstead would have been a pioneer in the use of standing MRI(pMRI) and Kinetic MRI (kMRI, weight-bearing with patient in a flexed, extended, etc. positions) as opposed to the most common recumbent MRI(rMRI). Like so many ideas, theories and opinions that Dr. Gonstead had, it has taken many years for the rest of the world to catch up with him. This incredibly advanced tool has done more to confirm Dr. Gonstead's genius as anything at our disposal today. As pMRI and kMRI get more use in the future, we will see this trend continue.

With various developments of the MRI, it has been possible to change patient positioning from lying down to standing. This change had led to some very interesting studies that compare a patient in various positions—not only standing but also in kinetic positions. For example, if a patient experiences the most symptoms while in extension and left lateral flexion, you can place them in that position and get an image. These kinetic images have demonstrated differences in the relationship between the disc's, ligaments, nerve roots, facets, foramina, central canal and revealed segmental instabilities. In addition, changes in the sagittal curves, increased severity of disc herniations and increased severity of spinal stenosis can be detected. Quite simply, the spine is dynamic and changes when stress is put upon it.

Studies done over the last fifteen years have evaluated different effects of p/kMRI versus rMRI. Those that evaluated the same effect may have resulted in different values but the changes to the spine were consistent. In other words, one study may have found an increase in the size of a disc bulge in 30% of those evaluated where the next study found a 55% increase in size. One consistent conclusion is that kMRI may reveal pertinent diagnostic findings that is more substantial than on rMRI or not present at all on rMRI. Here are some interesting statistics that I found in this regard.

— 'One or more disk protrusions were identified in 73.3% of scans performed in the sitting position and in 50.1% of scans performed in the recumbent position. Most disk protrusions occurred at L5-S1 (52.3% and 29.8%), L4-L5 (42.6% and 26.7%), and L3-L4 (26.7% and 13.1%) in upright and recumbent positions, respectively.' Gilbert<sup>1</sup>

— 'The geometric deformation of the discs under full body weight loading condition (upright standing) was determined using the supine, non-weight-bearing condition as a reference. The average maximum tensile deformation was -21% in compression and 24% in tension, and maximum shear deformation on the disc surface reached 26%. The data indicated that different portions of the disc

are under different tensile and shear deformation. Further, discs of L2-3, L3-4 and L4-5 have different deformation behavior under the physiological weight-bearing condition. In general, the higher-level discs have higher deformation values. The technique used in this study can be used to investigate the deformation behaviors of diseased discs as well as the efficacy of different surgical modalities at restoring normal disc deformation patterns.' Wang<sup>8</sup>

— of the 62% patients with posterior disc herniations on rMRI, 72% increased in size with upright MRI, 18% decreased in size with upright MRI. 11% were only seen on the upright MRI. 54% of spondylolisthesis showed increased slippage on upright MRI. Perez<sup>6</sup>

— 'Nerve root contact without deviation was present in 34 of 152 instances in the supine position, in 62 instances in the seated flexion position, and in 45 instances in the seated extension position.' Weishaupt<sup>11</sup>

— 'In the recumbent and erect series, the cervical spinal canal was larger in extension than in neutral and flexion at all levels. There were significant differences between canal size in extension, neutral and flexion.' Kuwazawa<sup>3</sup>

— 'Simply upright standing, or upright pMRI showed a phenomenon here termed "telescoping" whereby the levels of generalized intersegmental spinal degeneration showed a collapse of the spine into itself. Consequences redundancy of the discal, ligamentous and meningeal tissues of the spine resulted in increased degrees of central canal and lateral recess spinal stenosis....and increased degrees of neural foramen stenosis.' Jinkins<sup>2</sup>

— 'Increasing severity of focal posterior disc herniations on the neutral-p-MRI compared to the rMRI was noted and was yet worse in degree on extension-kMRI; these posterior disc herniations were less severe on flexion-k-MRI maneuvers as compared to all other acquisitions.' Jinkins<sup>2</sup>

— 'Additional valuable information was found in 50 of 172 patients (29%) during examination in axial loading. In the different diagnostic groups, additional valuable information was found in 69% of the patients with neurogenic claudication, in 14% of the patients with sciatica, and in 0% of the patients with low back pain. The percentage of additional valuable information increased to 50% in the patients with sciatica, if recommended inclusion criteria for examinations in axial loading were used. A narrowing of the lateral recess causing compression of the nerve root was found at 42 levels in 35 patients at axial loading.' Willen<sup>10</sup>

The more one reads the results of the effects of p/kMRI, the clearer the conclusion becomes, rMRI must be looked upon as limited in its spinal diagnostic value when compared to p/kMRI. Many of the conclusions of these studies re-iterate this opinion.

— '...evidence thus far indicates that p/kMRI may prove to be efficacious to incorporate as a part of the diagnoses-treatment paradigm in patients with spinal, radicular and referred pain syndromes originating from spinal pathology.' Jinkins<sup>2</sup>

— 'According to the study results, axially loaded imaging adds frequent additional valuable information, as compared with conventional imaging methods, especially in patients with neurogenic claudication, but also in patients with sciatica if defined inclusion criteria are used.' Willen<sup>9</sup>

— '...it was found that rMRI underestimated the effects of gravity-dependent spinal pathology and missed altogether pathology of a dynamic nature, factors that are optimally revealed with p/kMRI. Furthermore, p/kMRI enabled optimal linkage of the patient's clinical syndrome with the medical imaging abnormality responsible for the clinical presentation, thereby allowing for the first time an improvement at once in both imaging and specificity.' Madson<sup>5</sup>

As Gonstead Chiropractors, it comes as no surprise to us the strong relationship between weight-bearing MRI and the increased diagnostic information. Dr. Gonstead understood very well how dynamic the spine is. I believe he looked at each and every patient with a unique vision and understanding that resembled what we are seeing not only with rMRI and p/kMRI but what is currently being done with three dimensional MRI. It's our responsibility as Gonstead chiropractors to not only test, refine and improve Dr. Gonstead's work, but add to his immense body of knowledge. Weight-bearing MRI is certainly one of the tools that will aid us in this most noble endeavor.

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