Comparison of Outcomes in MRI Confirmed Lumbar Disc Herniation Patients With and Without Modic Changes Treated With High Velocity, Low Amplitude Spinal Manipulation

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Abstract

Objective: The purpose of this study was to determine if there is a difference in outcomes between Modic positive and negative lumbar disc herniation (LDH) patients treated with spinal manipulative therapy (SMT).

Methods: This prospective outcomes study includes 72 MRI confirmed symptomatic LDH patients treated with SMT. Numerical rating scale (NRS) pain and Oswestry disability data were collected at baseline. NRS, patient global impression of change to assess overall improvement, and Oswestry data were collected at 2 weeks, 1, 3, 6 months and 1 year. MRI scans were analyzed for Modic change present/absent and classified as Modic I or II when present. Chi-squared test compared the proportion of patients reporting relevant 'improvement' between patients with and without Modic changes and those with Modic I vs. II. NRS and Oswestry scores were compared at baseline and change scores at all follow-up time points using the unpaired Student *t* test.

Results: 76.5% of Modic positive patients reported 'improvement' compared to 53.3% of Modic negative patients ($P = .09$) at 2 weeks. Modic positive patients had larger decreases in leg pain ($P = .02$) and disability scores ($P = .012$) at 2 weeks. Modic positive patients had larger reductions in disability levels at 3 ($P = .049$) and 6 months ($P = .001$). A significant difference ($P = .001$) between patients with Modic I vs. Modic II was found at 1 year, where Modic II patients did significantly better.

Conclusion: Modic positive patients reported higher levels of clinically relevant improvement 2 weeks, 3 and 6 months compared to Modic negative patients. However, at 1 year Modic I patients were significantly less likely to report 'improvement', suggesting they may be prone to relapse. (J Manipulative Physiol Ther 2016;39:200-209)

Key Indexing Terms: *Modic Changes; Disc Herniation; Lumbar Spine; Outcomes Assessment; Manipulation, Spinal*

Modic changes describe and categorize three degenerative changes in the vertebral endplates and subchondral bone.[1] These changes are visible on magnetic resonance (MR) imaging, and there is a high interobserver reliability of diagnosis.[2] Modic type I is characterized by low signal intensity on T1-weighted sequences and high signal intensity on T2-weighted sequences. This corresponds to bone marrow edema.[1,3,4] Modic type II appears as high signal intensity on T1-weighted images and either high signal or intermediate signal intensity on T2-weighted images, the same as fat. Modic type III has low signal intensity on both T1 and T2 weighted sequences and would appear as sclerosis on routine radiographs.[1,5,6] The incidence of Modic changes and the number of affected levels increases with age and is common in the lumbar spine.[7,8] The natural course of MC is progressive with the most common pattern being that type I eventually converts to type II.[9–12]

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The link between MC and chronic low-back pain (LBP) has been established by many studies, particularly Modic type I, but the strength of this relationship varies greatly between different authors.[4,5,13–15] Furthermore there is a high prevalence of MC and other degenerative changes in asymptomatic individuals.[15,16]

Mitra et al found that there is a relationship between the evolution of Modic type I (conversion to Modic type II or extension in size) and a change in symptoms, but this relationship does not reach a significant statistical level.[15] Other studies have found statistically significant associations between the presence of Modic changes and degenerative disc disease, disc herniation at the same level as the Modic changes, Modic I and low back pain as well as a change in size of the MC type I and a change in intensity of LBP and disability.[17–24]

There are many studies evaluating the influence of the presence of MC on the outcomes from different therapeutic interventions on the spine, but the results are controversial.[25–31] Fayad et al found that intradiscal steroid injection produces a reduction of pain particularly in patients with Modic type I changes (inflammatory pattern) compared to patients with Modic type II changes, and suggested that steroid injection may be an efficient short-term treatment for patients suffering from LBP with inflammatory MC on MRI.[3] Zhuang et al also demonstrated the efficacy of the intradiscal steroid injection on the outcomes of patients presenting with MC, but did not find any difference in postoperative efficacy between different Modic types.[25] In 2014, Shan et al published a study in which they described the relationship between MC and the likelihood of resorption of disc herniations at a lumbar level.[31] They discovered that MC are associated with less probability of resorption of LDH and that these patients are less likely to improve with conservative treatment (rehabilitation programs). However, spinal manipulation to the level of the disc herniation was not one of the conservative treatments included in that study.

The role of spinal manipulation therapy (SMT) as a conservative treatment for symptomatic, lumbar disc herniation has been controversial over many years, but in 2014 Leemann et al published a study, which showed a high degree of clinically significant *improvement* in patients with leg and back pain due to a disc herniation who were treated with high velocity, low amplitude SMT to the level of herniation with no adverse events.[32] Another study by Peterson et al compared two groups of patients with symptomatic lumbar disc herniation, one treated with high-velocity, low-amplitude spinal manipulation and the other treated with imaging-guided nerve root injection.[33] The results showed improvement in a large percentage of patients, with no significant differences between the two treatment groups.

Several studies have confirmed the fact that MC are linked with disc herniation at the same spinal level and not only seen in patients with non-specific LBP.[1,4,5,23,24] Patients with this combination of lumbar disc herniation and Modic changes may actually have two sources for their *specific* low back pain. However, to date only 1 study has investigated whether or not there is a difference in treatment outcomes comparing patients with MRI confirmed symptomatic lumbar disc herniations with and without Modic changes.[34] The treatment in that study involved imaging-guided lumbar nerve root blocks and patients with Modic changes reported significantly worse outcomes compared to patients without Modic changes at 1 month post injection. While two studies have shown that spinal manipulative therapy appears to have a good effect on lumbar disc herniation (LDH) patients, and that most of the LDH patients undergoing this treatment are going to improve in the short- and in the long-term, neither study looked at whether or not there is a difference in outcome between LDH patients with Modic changes compared to those without Modic changes when treated with SMT.[32,33] Therefore the purposes of this study were to determine if there was a difference in outcomes between Modic positive and negative lumbar disc herniation patients treated with SMT as well as to compare treatment outcomes depending on the specific Modic type.

Methods

This study is a prospective outcomes study on adult patients presenting with a symptomatic, MRI-confirmed lumbar disc herniation and treated with high velocity, low amplitude spinal manipulation at a single practice in Zürich, Switzerland. It is a follow-up study from the publication by Leemann et al[32] The demographic information and the clinical outcomes were available on the University Chiropractic Medicine Department research database. The MR images regarding the patients were available on the database of this chiropractic practice.

The patients that were included in the study presented with symptoms and signs of a lumbar disc herniation, such as back pain and leg pain following a dermatomal pattern with or without myotome or reflex changes and with at least 1 other positive orthopedic test for LDH. When these clinical findings were consistent with the abnormal findings on the MR images concerning spinal level and side of the herniation they were included in the study.

The inclusion criteria for this study were the same as for the previous study by Leemann et al and were patient's age between 18 and 65 years, back pain and moderate to severe leg pain following a dermatomal pattern, and at least one of the following criteria: a) reduced straight leg raise test, b) deficit in detection of cold temperature, c) decreased response to pinprick, d) reduced muscle strength in a corresponding myotome, e) decreased or absent deep tendon reflex corresponding to the involved segment.[32]