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A Literature Review on MRI Findings for Lumbar Disc Pathology & P.T. Interventions

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Abstract

Lumbar disc pathology accounts for 39 % of all chronic low back pain. Genuine interest in finding any commonalities among the latest imaging studies published between year 2008 to 2015 concerning any findings for lumbar disc pathologies and their responsiveness to various physical therapy managements are the unique intentions of this literature review. This paper will not try to prove or disprove the effectiveness of PT managements, but to assess relative features of any MRI changes. Most of disc pathologies manifest as low back pain initially. Manual therapy, back stabilization exercises, yoga, & modalities were the managements used in these studies. Findings on MRI revealed disc regression, or disc translocation during McKenzie's repeated back extension and reduction in disc degeneration during yoga. One study did not report specific characteristic changes on their MRI findings. The remaining three studies did not generate general consensus for pertinent imaging findings.

Keywords: back pain, disc disease, discogenic, lumbar

A Literature Review on Lumbar Disc Pathology & Physical Therapy Treatments

Physical therapists provide a multi-faceted approach in the treatment of discogenic low back pain. Most of the common approaches available include manual therapy, lumbar stabilization, yoga, swimming, and traction. Depending on the stage and severity of disk pathology, it is a therapist's preference when choosing therapeutic interventions. There are no clear-cut, well-defined practice guidelines as when is it more meaningful and effective to choose manual therapy for this stage of disc pathology, versus that of traction for another phase. Hence, this literature study will try to look into the most recent literature available to glean if there are any imaging findings' predictive patterns that will guide in intervention selection.

Low back pain treatment approaches vary depending on symptoms, presentation and classification of condition (Delitto et al., 2012). It is debilitating that it is one of the most common cause of absenteeism from work and ranks number one as the leading cause of disability (Murray, Phil., & Lopez, 2013). On how the mechanism the disk becomes nociceptive remains a subject of debate, with structural changes in annulus, nucleus pulposus and vertebral end plates as ones involved in altering water diffusion (Adams & Roughley, 2006). As a person gets older the number of chondrocytes in the nucleus pulposus decreases, less proteoglycan is synthesized; the water content of the disc decreases and loses thickness. The discs are more fibrous and disarrayed, and the visual distinction between the annulus and nucleus is not clear. The absence of baseline values for apparent diffusion coefficient (ADC) on how the IV discs are hydrated is another challenge, and a diffusion-weighted MRI scans have potentials to perform this role (Newitt & Majumdar, 2005). There are five classifications of disc degeneration according to Pfirrmann classification from a clear, homogenous, hyperintense, bright white for Grade 1 to inhomogenous, collapsed, hypointense signal for Grade 5 (Maasumi, Tehranzadeh,

Muftuler, Gardner, & Hasso, 2011). Age-related degeneration appears as decreased signal intensity on T2-weighted MRI, resulting to 'black disc' appearance (Zhang, Guo, T. M., Guo, X., & Wu, 2009).

Literature Review

Unlu, Tasci, Tarhan, Pabuscu, & Islak (2008) conducted a trimodal analysis of acute herniated disc treatment for 15 sessions, over 3 weeks using traction, ultrasound therapy & low-power laser (LPL) therapy using MRI as an imaging tool for correlating clinical findings. Their study suggested a significant reduction in sizes of disc herniation among the four segment levels (L2 -L3 = n 6, L3-L4 n=17, L4- L5 n= 51 c, and L5- S1 n= 4) indicative of morphological regression of herniated disk during their repeated MRI. In their study, intergroup findings were not found, and although improvements were found as pain reduction and improvement in function scores, there were no correlations found between pain alleviation and the decrease in lesion size on their MRIs. However, a separate phase of this same study looked into traction's efficacy for an L5-S1 disc herniation with no displacement of S1 nerve root showed promising results after receiving combo managements of lumbar extension exercises on the first five visits for centralization, followed by lumbar traction on the remaining nine visits.

A study by **Leemann, Peterson, Schmid, Anklin & Humphreys** in 2014 that looked into the effectiveness of high-velocity, low-amplitude (HVLA) spinal manipulation in terms of their short-, medium-, and long-term outcomes. Selected participants with non-penetrated annular fibers were not excluded. Using Numeric pain rating scale (NPRS) and Oswestry as the yardstick to measure their improvement aided by MRI studies, the HVLA manipulation was dependent upon the lesion site whether they were intraforaminal or paramedian, with the former receiving modified push adjustment with a kick, while the latter receiving pull adjustment with a kick.

MRI-confirmed findings showed a pain reduction in the first two weeks, with sustained improvements lasting to 3 months before plateauing. Their study did not explicitly mention the characteristic findings on their MRI.

Broetz, Hahn, Maschke, Wick, Kueker & Weller in their 2008 prospective study of 11 patients wanted to check if a disc prolapse, even if sequestered could move or translocate using McKenzie's Back extension exercises and if these repeated end-range movement spinal movements gets manifested in their subjects' MRIs. Their findings revealed pain reductions as a response to this McKenzie approach with 8 out of 11 reporting centralization. Yet, there were no detectable changes in their MRI studies on the first week when reductions in pain were reported. These improvements were not correlated to MRI changes during their statistical data analysis.

Jeng, Cheng, Kung & Hsu (2011) delved into grading the characteristics of disc disease from 1 to 5, with 1 being normal, homogeneous hyper intense disc with normal disc height and 5 being inhomogeneous & hypointense (black) disc with collapsed disc space and a loss of distinction between nucleus and annulus. Using this grading among the various segments of the spines between yoga practitioners and those who never performed yoga, it was found that those who performed yoga were likely to have had lower scores, i.e., yoga group had significantly lower scores at three levels (C3/4, L 2/3 and L3/4) which signified a lesser degree of disc degeneration as reported and examined on their MRI findings. They reported that the various positions held by the spine during the yoga sessions retard disc degeneration by increasing the ability of nutrients to diffuse into the disc. They also mentioned that tension and compression of the disc during yoga exercises stimulate the synthesis of growth factors by the fibrocytes and chondrocytes residing in the disc and prevent their senescence.

Discussion

Findings from these four studies revealed and generated the following results: there was not enough description that focused on imaging studies and structural changes that took place after provision of physical therapy interventions. Pain reduction was not correlated to any imaging changes seen. The report in reduction of size of disc lesion by Unlu et al. did not show any statistical analysis for correlation coefficient and so it lacks power for conclusiveness to establish any relationship. This effect could possibly come from a 'strengthening effect' of the exercises to the muscles, and not to the discs. On the other hand, Leeman et al. utilized a subjective tool (NPRS) to report pain reduction and attributed these functional gains in score to MRI changes that were not accurately described. I saw this struggle in description due to lack of parameter or criteria to anchor for a baseline reference to what characterizes a normal change. Thirdly, 90% of Broetz et al.'s participants did not generate any MRI findings 3-7 days after entry into study. This lack of MRI changes could be due to acuteness of injury as not all T2-weighted MRI may not manifest edema post-injury (McKinnis, 2014). It is an accepted concept that an intact annulus will predict a centralization of pain ([Donelson, Aprill, Medcalf & Grant, 1997](#)). An identification of discogenic back pain is best predicted by patients' presentation of pain from posterior annulus zone' on MRI as a result of axial loading ([Adams, Freeman, Morrison, Nelson, & Dolan, 2000](#)). Pain from posterior annulus comes as a result of extremes of axial rotation or full flexion ([Krismer, Haid, & Rabl, 1996](#)). A reduction in pain is expected to take place over time for disc prolapse patient ([Henmi et al., 2002](#)). An immediate imaging is necessary during intervention application as delay in procurement will lead to a bias for normal healing process of the disc over time (a placebo effect). A separate prospective study conducted to verify if there are any verifiable MRI changes after 12 weeks inception of low back pain found that signal loss,

end plate changes or progressive facet arthrosis were not associated with acute events but were due to progressive changes due to age (Carragee, Alamin, Cheng, Franklin, van den Haak & Hurwitz, 2006).

Conclusions and Future Study

Findings from these literature studies did not result to characterizing imaging findings for disc-related back pain. Yet, there are some important concepts such as avoidance of axial loading when prescribing exercises to patients with disc pathology. This is strongly related to degenerative changes, although there is no gold standard tool for measuring lumbar compression load (Hung, Y.J.et al., 2014). Hours spent sitting significantly increased the prevalence of disc herniation. Sitting is also associated with loss of the lumbar lordosis, intervertebral disc (IVD) compression, and height loss, possibly increasing the risk of lower back pain (Fryer, [Quon & Smith, 2010](#)). Hence, offering variable positions when exercising patients as seen during yoga minimize axial loading. Little is known about the correlation between the extent of disc herniation and clinical signs and symptoms. There is the absence of generalization which is more superior P.T. intervention, 'though clinical studies point to McKenzie method as more effective than manipulation, or is equal to strengthening in addressing low back pain ([Manchikanti, Glaser, Wolfer, Derby & Cohen, 2009](#)). MRI studies are convenient tools to use for diagnostic purposes but these four literatures did not show predictability of MRI characteristics when these four interventions were used. McKenzie, traction, HVLA and yoga all exerted positive beneficial effects to patients with discogenic back pain. A future research such as a systematic review of various MRI findings that will employ PT interventions among participants with stringent criteria for homogeneity of participants will likely yield a chance for generalizing conclusion of this endeavor.

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