

THE EFFICACY OF CHIROPRACTIC SPINAL MANIPULATION AS A NON-  
INVASIVE TREATMENT FOR LUMBAR DISC HERNIATIONS

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# The Efficacy of Chiropractic Spinal Manipulation as a Non-invasive Treatment for Lumbar Disc Herniations

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## ABSTRACT

**Background:** Herniated discs of the lumbar spine are a major concern of health care professionals and the American public. A large majority of the United States population suffers from low back pain. Many experts believe that the pathological lumbar disc is the major contributor to low back pain. Statistics reveal that 0.1%-0.5% of American ages 24-64 will experience the presence of a lumbar disc herniation annually. Signs and symptoms of a LDH include low back pain, leg pain, numbness, paresthesia, weakness and atrophy. The LDH can potentially be debilitating forcing an individual to alter or halt their activities of daily living. The LDH has an enormous psychological, physical and emotional impact on the individual. The LDH also places an economic strain on the health care system and the workplace. Currently, many chiropractors utilize spinal manipulation as a treatment for a LDH. Identifying effective non-surgical modes of treatment are necessary to provide practitioners and their patients with viable options that are safe and cost-effective.

**Objective:** To provide an in depth analysis of the efficacy of chiropractic flexion distraction and side posture manipulation as non-surgical treatments for a lumbar disc herniation. An exploration of the lumbar spine anatomy provides the reader with an overview of the vertebrae, intervertebral disc and the surrounding ligaments. An exploration of the lumbar disc herniation provides insight regarding its causes, biomechanics, pathophysiological mechanisms, associated symptoms and diagnosis. Further, flexion distraction and side posture manipulation, the chiropractic techniques under inquiry, are presented thoroughly and that the application, mechanics and proposed effects are realized. Lastly, the research furnishes an in depth review of current literature on the topic in order to resolve the research question: Are the two aforementioned chiropractic techniques effective treatments of lumbar disc herniations?

**Data Sources:** The compiled literature consists of sample population studies, anecdotal studies or case studies, literature reviews, clinical reports and four classical studies from indexed refereed sources that discuss the lumbar disc herniation including but not limited to history, examination, imaging, pathophysiology, treatment and outcome measures.

**Results:** The researcher utilized a critical analysis methodology to resolve the research question. Based on a preponderance of evidence, the researcher concludes that the chiropractic techniques, flexion distraction and side posture manipulation, are potentially effective non-invasive treatments for a herniated lumbar disc. The literature shows the effectiveness of each technique when utilized alone, with each other and/or in conjunction with physiotherapy modalities and exercises. Of the 26 reviewed studies, 26 (100%) had positive results regarding the efficacy of the techniques as viable treatment options.

**Conclusion:** In the future, further investigation is needed that will examine larger samples, include longitudinal studies and randomized control studies that control for the effectiveness of each technique by itself. Although many health professionals refer patients with LDH to a chiropractor based on anecdotal evidence, there are those that will require large population, longitudinal randomized and controlled evidence to base their clinical judgments. All together, this thesis explores the topic of chiropractic manipulation as a treatment of a lumbar disc herniation. A thorough examination of the topic, its components and current literature allowed the researcher to settle the research question. The researcher discovered that chiropractic spinal manipulation is capable of reducing a lumbar disc herniation, the associated symptoms, restore daily function and/or prevents a reoccurrence of the condition.

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## CHAPTER 1

### Introduction

Herniated discs of the lumbar spine are a major concern of health care professionals and the American public. According to Polkinghorn and Colloca (1998), 60-80% of the general population will suffer from low back pain (LBP), which is one of the most prevalent symptoms responsible for visits to primary care physicians. The herniated disc can potentially be the major contributor to LBP symptoms. Barrale, Diamond, Filson and Wittmer (1989) refer to disc protrusion [herniation] as being the cause of 95% of all back pain. Additionally, LBP has had an enormous societal impact both economically and in the workplace. Every year in the United States 93 million workdays are lost and five billion dollars is spent on the diagnosis and treatment of LBP (Neault, 1992). Zindel (1989) states that LBP is the most frequent cause of disability in the United States in people under 45 years of age and is the second largest cause of absenteeism.

Sciatica, which refers to radiating pain down the posterior thigh that extends past the knee and possibly into the toes, is relatively common in the general population. From a large survey conducted in the United States, it was estimated that up to 12% of low back sufferers reported the symptoms of sciatica (Deyo and others, 1987). It was also estimated that the annual incidence of LDH in the population aged 24-64 years old is 0.1%-0.5% (Kelsey, 1982), with a peak incidence between the ages of 30-55 years of age (Deyo and others, 1992). Approximately 5% of all patients with LBP, who seek professional advice, suffer from a lumbar disc herniation (LDH) (Roland 1983).

The term disc herniation refers to, “the protrusion of the annulus without complete tearing of the outermost fibers...” (Barrale, Diamond, Filson & Wittmer, 1989, p.79). The herniated disc slowly migrates out of its intervertebral space and into the epidural space. The herniated or protruded disc will come in direct contact with the nerve root or spinal cord, which is referred to as mechanical radiculopathy or myelopathy, respectively. A clear distinction must be made between a disc herniation and bulge. A disc bulge refers to the circumferential tearing within the annular fibers that does not cause mechanical pressure to nervous tissue. Although there is an absence of mechanical pressure on the nerve tissue with a disc bulge, chemical irritation may cause a similar patient presentation as direct nerve root pressure due to herniation. In a 1996 article, BenEliyahu states that intervertebral disc herniations are a frequent contributor to extremity pain that often includes radiculopathy. Herniated discs lead to more serious symptoms that extend into the lower extremity and patients will often present with more than LBP. Possible symptoms include paresthesia, numbness, weakness, atrophy... (Pollard & Tuchin, 1995). Additionally, herniations occur most frequently in the lumbar area of the spine. According to Plaughner (1995), “The highest incidence of clinically significant protrusions occur in the lower lumbar discs.” Based on the prevalence, the potential disability and the severity of the symptoms that can result from a LDH, identifying effective modes of effective treatment are necessary.

#### Statement of the Problem

Presently, treatments for herniated lumbar discs include both surgical procedures and non-surgical treatments such as medication, physiotherapy and chiropractic manipulation or adjusting. According to Roberts and Robinson (1994), effective non-surgical treatments include oral narcotics, muscle relaxants, anti-inflammatories and bed

rest, followed by physical therapy (i.e. traction, electrical stimulation, exercise). Saal and Saal (1989) performed an outcome study of 58 patients and the effectiveness of an aggressive rehabilitation program consisting of education and spinal stabilization exercise training. The authors found that 90% had a good or excellent outcome with a 92% return to work rate. Weber (1982) conducted a controlled, prospective study with ten years of observation comparing the long-term effectiveness of surgical intervention as compared to medication, physiotherapy and "back-school". The author found that the surgical group showed as statistically significant advantage over the non-surgical group at one year. However, after 4 years there was no statistical advantage in the surgical group and only minor changes, although statistically insignificant, took place over the last 6 years of the study. Weber (1982) concluded:

"...approximately 60% of the operated patients may have been submitted to an unnecessary procedure. Even though the operated patients generally expressed their satisfaction with the result, an operation should not be performed if other treatment will give an equivalent result within an acceptable period of time.

Consequently, if the neurologist or another specialist is in doubt regarding further treatment, the patient with low back pain and sciatica should not automatically be referred to the surgeon, The fact that the immediate prognosis after surgery is better does not alter this view" (p.137).

Bassette and others (1996) evaluated Weber's study and stated that although the study had some limitations, the author did not overstate his data. They concluded that most physicians believe surgical intervention to be the best choice for patients with pain that is not responsive to conservative care. However, based on the existing literature, they



believe that surgery is probably not better than conservative care for the patient in the long term.

Many studies have been administered determining the capability of surgery or invasive procedures for the reduction of a lumbar disc herniation. Eriksen (1998) refers to nine studies that found the success rate of surgery to be as high as 70-96% with a 10% chance of the condition worsening. However, other studies have shown the ineffectiveness of surgery for the treatment of LDH. The rate of back surgery in the U.S. was at least 40% higher than in any other country and was more than five times those in England and Scotland according to a 1994 investigation by Cherkin. He added that the rate of back surgery in the U.S. has increased proportionately with the per capita supply of orthopedic and neurosurgeons in the country. Weber (1994) also stated that 90% of patients with four months of sciatica respond to non-surgical, energetic care. According to claims made by the Medical profession, 90% of the 250,000 back surgeries can be avoided (Stano, 1993). Additionally, Lanier (1993) reported that only 5-10% of patients with symptomatic lumbar disc disease require surgery. Interestingly, Teplick and Haskin (1985) report the spontaneous regression of herniated nucleus pulposus in 11 patients on follow-up CT study. The mechanism of this phenomenon is unknown and its rate of occurrence should be further studied since it may deem surgery unnecessary. Additionally, conservative therapy may be receiving clinical credibility for patients whose LDH spontaneously regresses.

According to the popular Rand study (Shekelle, 1994), patients who were diagnosed with sciatica made up 3% of total visits to the chiropractor, as compared to 2.2% of total visits to the medical doctor. In addition patients diagnosed with lumbar disc displacement made up 6.3% of total visits to the chiropractor, as compared to 4.7%

of total visits to the medical doctor. According to these statistics, either a larger percentage of patients are accessing chiropractors for treatment or chiropractors are diagnosing the condition more often. Further study into these questions is necessary in the future. However, the authors of the Rand study were hesitant to conclude that chiropractic is an effective treatment for LDH: "For patients with sciatica, there is a non-significant trend toward more improvement in patients treated with manipulation..."

(p.13). It is noted that the authors reached the aforementioned conclusion based solely on two clinical trials which they did not cite yet deemed "methodologically weak".

Schmidt (1992) performed a cost comparison and found that the cost of chiropractic care is significantly lower for disc disorders. Another study gathered information from claims from the 1986 Utah Workers Compensation Fund (Jarvis, 1993). The comparison was for the medical and chiropractic treatment of the lumbosacral disc (L5-S1). The MD's saw an average of 44 cases with an average total cost of \$8,175 per case. The DC's saw an average of 52 cases with an average total cost of \$1,065 per case. The cost effectiveness of medical treatment vs. chiropractic care is outside the scope of this literature review. Nonetheless, the researcher believes that the lower cost of chiropractic care warrants this investigation into the efficacy of chiropractic care for the treatment of the LDH. Recent guidelines have been published by the Agency for Health Care Policy and Research (AHCPR), a division of the US Department of Health and Human Services (1994). These guidelines state that for the clinical presentation of acute low back problems (defined as low back or low back and back-related leg symptoms of less than 3 months' duration), "Relief of discomfort can be accomplished most safely with nonprescription medication and/or spinal manipulation."

Although the effect of surgery on herniated lumbar discs has been thoroughly investigated, the impact of chiropractic manipulation on herniated lumbar discs has received less attention. Chiropractic is a comparatively younger profession than medicine with less resources, personnel and research funding.

Several chiropractic techniques are currently being utilized clinically for the treatment of a lumbar disc protrusion. These techniques include flexion distraction manipulation and rotational manipulation (AKA side posture manipulation). Roberts and Robinson (1994) conclude that chiropractic techniques may be helpful but more reliable data is needed to determine whether or not a disc can be manipulated back into place. The purpose of this study is to collect and critically analyze the current research on the efficacy of chiropractic manipulation as a non-invasive treatment of lumbar disc herniation.

The researcher is revisiting the topic, which was first evaluated in 1999. The purpose of a follow-up literature review is to re-examine the research question four years later. The researcher believes that a new study of the research question is warranted for the following reasons: 1) Update the study with current literature 2) The researcher has increased access to chiropractic literature at Logan College of Chiropractic, Chesterfield, Missouri 3) The researcher's knowledge base of the subject has increased since the 1999 critical analysis.

#### Research Question

Are chiropractic spinal manipulation techniques an effective non-invasive treatment of lumbar disc herniations?

### Delimitations

The data, which will be examined, will only reflect those individuals who meet the following criteria: 1) the data collected in this investigation pertains to individuals suffering from a single or multiple lumbar disc herniation. 2) The data collected in this investigation will reflect individuals who receive spinal manipulation as an intervention for their condition. 3) The obtained information will represent those individuals who are adults above 16 years of age. 4) The data collected will reflect all patients' post care outcome.

### Limitations

The compiled research does not generalize regarding individuals who meet the following criteria: 1) the research cannot imply generalizations for individuals suffering from intervertebral disc herniations outside the lumbar area of the spine. 2) The research cannot generalize for individuals suffering from back or leg pain resulting from any other condition other than lumbar disc herniation (i.e., bulge, protrusion). 3) The research cannot generalize an outcome for individuals seeking other forms of treatment other than spinal manipulation. 4) The research cannot account for the generalizability for individuals suffering from a herniated lumbar disc under the age of 16 since minimal documentation of such cases exists. 5) The research cannot generalize regarding an individual's symptoms prior to chiropractic treatment.

### Definition of terms

1. Chiropractic- “A science based on the theory that health and disease are life processes related to the function of the nervous system; a method of restoring wellness through adjustments of the spine” (Marti, 1995, p.286).
2. Annulus fibrosis- A ring of fibrocartilage and fibrous tissue surrounding the nucleus pulposus, which together make up the intervertebral disc (Spraycar, 1995).
3. Nucleus pulposus- “The soft central portion of the intervertebral disc” (Spraycar, 1995, p.578).
4. Lumbar disc herniation- “...protrusion of the annulus fibrosis, without complete tearing of the outermost fiber, so that the nuclear material is not lost” (Barrale, Diamond, Filson & Wittmer, 1989, p.79). One of the five lumbar discs migrates away from the proper intervertebral space into the epidural area.
5. Spinal Radiculopathy- Disease of the spinal nerve root with one cause being mechanical contact by a herniated disc resulting in neurological deficit (i.e., paresthesia, weakness, hypo- or areflexia) (Cassidy, Theil & Kikaldy-Willis, 1993).  
Radiculopathy may be caused due to chemical irritation in the absence of direct mechanical pressure.
6. Manipulation/Adjustment- “Therapeutic application of manual force spinal manipulation therapy broadly defined includes all procedures where the hands are used to mobilize, adjust, manipulate, apply traction, massage, stimulate or otherwise influence the spine and paraspinal tissue with aim of influencing the patients health” (Bergman, 1993, p. 426).
7. Flexion-Distraction- Manual procedure, performed with the patient prone, which results in the movement of two lumbar segments away from each other. BenEliyahu

(1996) defines the technique as, “the specific manipulative traction in the axial plane to the intervertebral disc”, otherwise referred to as the Cox technique (p. 599).

8. Rotational Manipulation/Adjustment- Also referred to as side posture manipulation. “...a counter rotation of levers occurs with upper torso rotation in one direction and pelvic rotation in the other direction...it is possible to localize the manipulation to a single segment” (Cassidy, Theil & Kirkaldy-Willis, 1993, p.99).
9. Traction- Therapeutic method which utilizes an intermittent pulling “apart” of the upper torso from the lower body in order to cause a brief lengthening of the spinal cord and its segments. Otherwise referred to as distraction.
10. Centralization- “...the term used to denote a decrease in extremity pain; the pain recedes from the distal area of the body, thus becoming more proximally located” (Lisi, 2001, p. 596).
11. Peripheralization- the opposite of centralization, in which proximal pain moves distally down an extremity (Lisi, 2001).

#### Assumptions Underlying the Study

The following assumptions have been made during the research process of this study:

- 1) The data, which was obtained from previous research on the topic of lumbar disc herniations, is valid, accurate and substantiated by a reliable peer review.
- 2) The researchers, whose data will be utilized, conducted their research without any bias.
- 3) The data obtained was in reference to patients who were diagnosed properly with the clinical presence of LDH. The researcher assumes that the patients were not misdiagnosed.
- 4) The researcher assumes that the chiropractic techniques under investigation were employed properly and consistent by the health care providers.

### The Importance of the Study

Herniated lumbar discs, the most prevalent disc protrusion, are a primary cause of LBP and leg pain in the U.S. (Saal 1989). Patients who develop disability due to the presence of LDH are often referred for surgical intervention. Furthermore, other symptoms arising from a herniated lumbar disc can be far more critical. The condition has put a financial strain on the health care system and society. It is imperative that effective modes of treatment be discovered in order to return patients to their activities of daily living. Although research shows that surgery may be an effective decompression treatment for a LDH, an effective non-invasive treatment would be most preferential for the patient. Even amongst the medical profession, there is debate over whether a LDH patient should be managed with surgery or conservatively with physiotherapy. The research varies regarding the effectiveness of physiotherapy in the treatment of the LDH patient. This study will determine the efficacy of chiropractic spinal manipulation as a non-invasive treatment for individuals who suffer from a herniated lumbar disc. The researcher has realized that many chiropractic practitioners incorporate the use of physiotherapy as an aspect of their chiropractic treatment plan.

### The Sample and Admissibility of the Data

The data amassed in this study consists of a selection of references regarding the topic of the treatment of lumbar herniated discs through spinal manipulation.

The compiled data must meet the following criteria in order to be put to use in this study:

- 1) the data collected was published in peer refereed journals.
- 2) The references used in this study are primary sources.
- 3) The research compiled is relevant to the topic of treatment of herniated lumbar discs by spinal manipulation.

## Methodology

The methodology, which the researcher will be utilizing in this study, will be a critical analysis. The researcher intends to investigate the topic by thoroughly examining its particular components. Several key components include the anatomical background of the lumbar area and a herniated lumbar disc. The pathophysiology of a herniated disc will be discussed through an examination of the causes, biomechanics, diagnosis and symptoms. Next, two current chiropractic techniques, which are currently used for the treatment of a LDH, will be investigated by examining their application and the mechanisms responsible for disc reabsorption. Lastly, there will be a review of the literature in order to resolve the research question.

### Projected Treatment of the Research Question

The following is a discussion of the data necessary to conduct this study, where the data was retrieved, the method in which the data will be secured and the procedure in which the data will be treated and interpreted: 1) The data needed includes current and past research collected from peer reviewed journals related to the topic of investigation. 2) The data has been located at the learning resource center at Logan College of Chiropractic in Chesterfield, Missouri, National Library of Medicine in Bethesda, Maryland and McKeldin Library at the University of Maryland at College Park. 3) The data will be secured by photocopying the applicable journal articles and literature. Useful article content will be highlighted for later reference. 4) The data will be interpreted by utilizing descriptive statistics. Deductive reasoning will enable the researcher to critically analyze and draw conclusions regarding all components of the research. A final determination of the data will be formed quantitatively based on frequency distribution of the sources and a preponderance of evidence.



### Special Concerns

Upon the commencement of this research endeavor, the researcher has confronted a few obstacles that have been of significant concern. Chiropractic is barely over 100 years old, which makes it a relatively young field. As a result of the short duration of the chiropractic profession, there are fewer established researchers and resources in comparison to the more established field of medicine. A large portion of the literature was in the form of case studies and few randomized controlled clinical trials existed. Additionally, the researcher felt a subjectively negative undertone when reading some of the medical journals and the opinions that medical doctors hold towards multiple forms of alternative health care. Nevertheless, many of the doctors of chiropractic display a bias undertone in their literature as well. Therefore, it was necessary for the researcher to carefully examine the literature and expel any materials that seemed biased. The researcher was careful not to impose personal bias on this investigation and reviewed and reported the literature in an objective manner.

### Future Chapters

The ensuing chapters of this thesis will be separated into components necessary to critically analyze the efficacy of chiropractic spinal manipulation as a non-invasive treatment for the herniated lumbar disc. Initially, in chapter two, there will be a discussion of the anatomical background of the lumbar area (e.g. vertebrae, intervertebral discs, spinal cord). Additionally, background information regarding the pathophysiology of a herniated lumbar disc will be presented. This discussion will include the causes, biomechanics, diagnosis and associated symptoms of a lumbar disc protrusion. Chapter three will expose several of the presently utilized chiropractic techniques for the treatment of a LDH. These techniques include flexion distraction and rotational

manipulation or side posture manipulation. A thorough examination of the techniques will be accomplished by investigating the application of the techniques as well as, the mechanisms responsible for a potential treatment. Lastly, chapter four will be a review of the literature. In this chapter, the researcher plans to present the findings of the compilation of studies that have been completed on the effectiveness of spinal manipulation techniques as a treatment for a LDH. The final chapter will consist of a summary and conclusion of the thesis. The conclusion will intend to resolve the research question pertaining to the effectiveness of chiropractic spinal manipulation as an alternative non-surgical treatment for lumbar disc herniations.

## CHAPTER 2

### Anatomical and Physiological Background

In order to adequately analyze and comprehend chiropractic manipulation and its effect on herniated lumbar discs, an overview of the anatomy of the lumbar area and the pathophysiology of a herniated disc is fundamental. This chapter will provide a general review of the vertebral column, intervertebral discs, associated ligaments and other critical components of the lumbar spine. Additionally, a survey of the pathophysiology of a LDH is relevant in understanding the implications that a LDH has on the human body. An examination of lumbar disc protrusion will include its causes, biomechanics, associated symptoms and diagnosis.

#### The Anatomy of the Lumbar Area

The vertebral column is the single most significant structure in the human skeleton. A progressive series of bones encompasses the spine and serves as a framework for the body, houses the central nervous system (e.g., spinal cord) and is the foundation of many of the body's movements. The five lumbar vertebrae, which are located inferiorly on the spine, are the largest of the vertebrae and are shown in Figure 1. The main function of these vertebrae is support, however, the lumbar vertebrae are also responsible for the formation of the lordotic curve (s-shaped curve) found in an anatomically correct spine. The lumbar spine is numbered from top to bottom or L1 to L5. The intervertebral discs make up the amphiarthrodal joints between each bone are referred to by this number system. For instance, a herniation occurring between the first and second lumbar disc is referred to as an L1-L2 herniation. The sacrum is the bone located inferior to L5 and the lumbosacral joint is referred to as L5/S1.

## The Vertebra

Kreinbaum and Barthels (1996) discuss the individual vertebra, which can be seen in Figure 2. Protruding from the posterior arch of each vertebra are two transverse processes and one spinous process. These processes serve as attachment sites for the many muscles and ligaments of the lumbar region. The central canal refers to the space within the vertebra where the spinal cord resides. The spinal cord is part of the central nervous system and transmits electrical efferent messages from the brain to the rest of the body via nerves. Likewise, it transmits afferent messages from the peripheral nervous system back to the brain. Each vertebra has a cylindrical body, which is responsible for bearing much of the load placed on this section of the spine. Protruding posteriorly from the body are two stems, which make up the neural arch. At the end of these stems are two inferior and two superior facets. The superior facets of one vertebra articulate with the inferior facets of the vertebrae above. This articulation constitutes a synovial joint, which is lined with cartilage and enclosed by a joint capsule.

## The Lumbar Disc

The lumbar vertebrae endure a large amount of compressive stress administered during bipedal activities (Kreighbaum, 1996). Between each vertebra is a fibrocartilage intervertebral disc which main function is shock absorption and is shown in Figure 3. In addition to the facet articulation, there is a second articulation between successive vertebrae, separated by the intervertebral disc. According to Cassidy, Theil and Kirkaldy-Willis (1993), the lumbar disc is the largest avascular structure in the body and is composed of two major regions. The first, being the central nucleus pulposus which has fluid-like properties under low force stresses and solid properties under high stress forces.

The amount of nucleus diminishes with age and results in a loss of disc strength (Kreinbaum & Barthels, 1996). Dehydration and lack of motion contributes significantly to degenerative disc disease since motion is necessary for the flow of nutrients into the disc. The second region, referred to as the annulus fibrosus, surrounds the nucleus pulposus. The annulus stabilizes the disc and helps contain the nucleus. The annulus is made up of fibrocartilaginous rings with alternating fiber orientation. Micro and macro tears to these fibers lead to a weakening of the structure, altered function and the eventual occurrence of a LDH. The lumbar intervertebral disc is the central focus of this paper. Several instructors at Logan College of Chiropractic believe the disc's function and alignment are crucial to the human body:

“Because the lumbar intervertebral disc comprises two-thirds of the anterior boundary of the intervertebral foramen and because in this region the disc causes the lordotic curve, it is considered by many to be the most important factor in maintaining the biomechanical integrity of the lumbar spine” (Barrale, Diamond, Filson & Wittmer, 1989, p.79).

The configuration of the intervertebral disc causes the spine to lack bony stability and rely on ligament and muscular support. Seven of the ligaments that hold the vertebrae together are shown in Figure 3 and include the intervertebral disc, anterior longitudinal, posterior longitudinal, supraspinous, interspinous and intertransverse ligaments (bilaterally). The posterior longitudinal ligament narrows in the lower lumbar spine, hence providing less support to the posterior disc than at more cephalad segments.

## The Anatomy and Pathophysiology of the Lumbar Disc Herniation

The lumbar disc herniation is defined by Barrale, Diamond, Filson and Wittmer, in their 1989 article as the, "...bulging, swelling, or protrusion of the annulus without complete tearing of the outermost fibers, so that the nuclear material is not lost" (p. 79). Basically, a portion of the disc migrates out of the intervertebral space through torn inner annular fibers and into the neural canal. An important aspect in the prevention and treatment of a LDH is an understanding of the biomechanical stresses that the intervertebral disc endures. The particular movements that are responsible for disc herniations are directly related to the biomechanics of a LDH. Nevertheless, awareness of the pathophysiology of an LDH provides insight regarding symptoms and allows for a reliable diagnosis.

### Causes

Many of our everyday activities can lead to the onset of an LDH. Often, the cause of LDH is engaging in these activities improperly. Although disc herniation can occur suddenly, it is usually a progressive condition that is a result of poor repetitive activity. According to Cassidy, Theil and Kirkaldy-Willis (1989) improper lifting, prolonged sitting and poor posture causes a combination of flexion and increased pressure on the disc. The disc then becomes weaker and lordosis is lost. A misalignment of the spine can cause a shift in the nuclear material within the disc, which leads to disc herniation. Rotation, flexion and axial loading are the most stressful movements responsible for damaging the disc. Barrale, Diamond, Filson and Wittmer (1989) cite that performing rotation and flexion of the lumbar spine concurrently is "the single most damaging force"

in regard to disc injury. The disc will continue to endure increased stress and begin to degenerate, eventually becoming herniated.

Even though imperfect movements can cause disc degeneration, the degeneration of the disc can result in faulty movements making the process cyclic. Barrale, Diamond, Filson and Wittmer (1989) refer to the cycle by stating, “vertebral rotation and lateral flexion abnormalities and distortions may have preceded derangement of the disc or may have resulted from such derangement” (p. 81). As a person ages, there is a progressive loss in fluid like material of the nucleus pulposus or desiccation. As a result, the lumbar disc becomes thinner and gradually loses its shock absorption capacity and can no longer endure the stresses imposed. (Kreinbaum and Barthels, 1996). Coupled with improper body mechanics, the lumbar disc does not receive its proper nutrients through the natural process of imbibition. The LDH may be inevitable in an aging individual.

Terry Yochum and Lindsay Rowe (p.501) provide a thorough explanation regarding the pathophysiological mechanism of the intervertebral disc (IVD). The mechanical behavior of the IVD is directly related to its hydration status. The factors related to the age-dependent changes of the IVD are linked to the disc’s biochemical constituents.

“Aging results in a decline in the proteoglycan concentration and an increase in the ratio of keratin sulfate to chondroitin sulfate. As the collagen and the collagen-proteoglycan binding of the nucleus pulposus increases, a decline in the water-binding capacity occurs, resulting in a dehydrated, fibrous and rigid intervertebral disc (Yochum and Rowe, p.501).”

The authors add that the biochemical changes in the disc lead to aberrant load distribution through out the annulus and nucleus of the disc. Activities of daily living, including

repetitive stresses can lead to annular fissuring. The nucleus progressively migrates through these tears in the pain sensitive annulus (outer 1/3). When the fissures extend to the outer margin of the annulus a herniation can occur.

Another mechanism of nuclear degeneration was proposed by Bogduk and discussed by Yochum and Rowe (p.501). The authors state that microfractures in the endplate of the vertebral body interrupt the vascular channels that imbibe nutrients into the disc. An autoimmune response at the site of the IVD may initiate further degradation of the nuclear matrix.

Educating the general population about proper mechanics and posture is a crucial step in the prevention of a LDH. Spinal hygiene or “back-school” are often used in most treatment programs designed by chiropractors and/or physiotherapists.

#### Pathomechanics of an LDH

Barrale, Diamond, Filson and Wittmer (1989) attribute that the biomechanics of the lumbar disc herniation occur when the lumbar disc is exposed to compressive stresses resulting from twisting and flexion movements. In the case of a posterior-lateral disc bulge, there is increased stress placed on the disc anteriorly from the vertebra above. This often takes place when there is a loss in lordosis. While the disc is compressed anteriorly, the nucleus pulposus shifts posteriorly. Consequently, there is an increase in intradiscal pressure anteriorly and possibly a hydrostatic pressure placed upon the posterior annular fibers by nuclear material. Over time the annular fibers lacerate, beginning within the disc among the central fibers, which adjoin the nucleus. This is a nuclear contained disc herniation and can be seen in Figure 4B. The vertebrae above shift even further, so there is an unbalanced weight imposition below. The pressure on the



side of the initial laceration increases, resulting in the movement of the disc posteriorly as seen in Figure 5 or laterally as shown in Figure 6. Nuclear pressure on the annulus fibers increases until there is a reduction or elimination of the pressure. Decompression can occur pathologically during a complete tear or prolapse. On the other hand, decompression can occur therapeutically either surgically or conservatively. In the absence of clinical intervention there is a progressive widening of the gap and deepening erosion. The process continues until the disc migrates into the neural canal approaching the spinal cord and other nerves located in the intervertebral foramen. The disc may eventually come in contact with the spinal cord, dorsal root ganglion or nerve root, which is referred to as myelopathy or radiculopathy, respectively (Cassidy, Theil & Kirkaldy-Willis, 1993). In this scenario, there is an increase in the severity of the symptoms. Symptoms are usually exacerbated in the seated position and relieved by standing or lying supine due to changes in intradiscal pressures. The clinical evaluation including orthopedic and neurological assessment, as well as advanced imaging is outside of the scope of this paper and will not be discussed. Eventually, if the herniation is not reduced, the nuclear material may cause a complete tear in the annulus fibrosus. The LDH may progress from a nuclear contained herniation to a non-contained herniation, which can be seen in Figure 4C.

The annulus fibrosis may continue to tear until the nuclear material breaks through its outermost fibers. The non-contained herniation is referred to as nuclear prolapse. The lumbar disc is the largest avascular structure in the body. According to Cassidy, Theil and Kirkaldy-Willis (1993), when the disc's contents come in contact with the body's normal immune mechanisms, in the neural canal, this can trigger an autoimmune inflammatory response. This inflammation in the lumbar area applies a

chemical pressure to the nerve root resulting in sciatica and/or neurological deficit. (Cassidy, Theil & Kirkaldy-Willis 1993). Sciatic radiculopathy or paresthesia felt in the leg below the knee and into the little toe is one of the many symptoms associated with LDH.

### Symptoms and Diagnosis

The symptoms associated with a LDH can range from mild to debilitating. A posterior lateral disc bulge may produce a mechanical, inflammatory or chemical irritation (Barrale, Diamond, Filson & Wittmer, 1989). Often, the mechanical deficit imposed by an LDH will result in poor body mechanics attributing to muscle soreness. The most common symptom resulting from LDH is low back pain. According to Barrale and others (1995), the disc herniation is attributed to be the cause of 95% of all back pain. However, the health care provider must differentiate a disc bulge, with circumferential tearing of the annulus, from many other causes of low back pain. Lower back pain plagues the majority of our population and has economical implications as well. Polkinghorn and Colloca (1998) state that 60-80% of the general population will suffer from lower back pain. Every year, millions of workdays are lost and billions of dollars are spent on the diagnosis and treatment of low back pain (Neault, 1992). Since LDH is a progressive condition, the severity of its symptoms lies on a continuum. If the condition worsens to the extent that there is radiculopathy, symptoms may include lower extremity pain, paresthesia, numbness, and weakness (Pollard & Tuchin, 1995). As previously stated, in the presence of prolapse, the nuclear material will trigger an inflammatory response that is often associated with sciatica (Cassidy, Theil & Kirkaldy-Willis, 1993). These symptoms will continue and have the potential of worsening if there is not an

elimination of the disc herniation. Roberts and Robinson (1994) refer to the significance of the localization of the herniation since there are characteristic signs and symptoms at each level of the lumbar spine. Importantly, a reliable clinical diagnosis of the herniated disc should be accomplished at the onset of symptoms and equally important, after treatment to determine the location and extent of the herniation. As stated earlier, the researcher is examining the efficacy of chiropractic treatment and the neurological and orthopedic examination is outside the scope of this paper.

Patient examination is the initial step in the diagnosis of LDH. Patient response can provide the health practitioner with valuable information regarding the location of the disc herniation. For instance, a patient, who sustains a herniation in the lower portion of the spine (L4-L5 and L5-S1), experiences a weakness of plantar flexion and a limitation in flexion of the lumbar spine (Roberts & Robinson, 1994). However, a herniation at the L3-L4 level will generally cause a weakness of leg extension because of the direct involvement between the nerve root and the quadriceps femoris muscle. Additionally, the patient's postural presentation or antalgia provides the clinician with relevant information regarding the location of the disc herniation in relation to the nerve root. Antalgia is a posture that the patient assumes in order to reduce their perception of pain. Hoppenfeild describes antalgia, "When the patient is standing, an obvious inclination or listing to one side or the other may be a sign of a possible sciatic scoliosis, secondary to a herniated disc" (p.238).

Diagnostic studies include x-rays, magnetic resonance imaging (MRI) or computerized tomography (CT) scan. However, it must be noted that the use of magnetic resonance imaging (MRI) is the current gold standard in the assessment and diagnosis of disc lesions. Yochum and Rowe discuss the diagnostic imaging of the IVD, "MRI has

replaced CT and CT myelography as the imaging modality of choice for disc herniations at any spinal region” (p.490). X-rays have the ability to show degenerative joint disease through diminished vertical space, osseous hypertrophy or a loss of the lordotic curve. It may also point to a lateral disc bulge if a functional antalgic scoliosis can be seen.

However, X-rays should be used in conjunction with MRI or CT scan since they are not as effective in the imaging of soft tissues such as the lumbar disc. CT or MRI scanning allows for lateral or posterior foramen disc bulges to be clearly visualized. Roberts and Robinson (1994) refer to the efficacy of these diagnostic methods by stating, “If both scans fail to reveal a ruptured disc, the chances are overwhelming that the patient’s problem is something else” (p.580). Identifying the symptoms and recognizing the condition of LDH is the first step in treating the treatment process.

#### Summary

In this chapter, a comprehensive anatomical overview of the lumbar spine and LDH was presented. Additionally, the causes, biomechanics, symptoms and diagnosis of LDH were discussed in order to familiarize the reader with the condition. Understanding the physiology and pathophysiology of the spine and the intervertebral lumbar disc will enable one to comprehend the treatments that will be discussed. Based on the potential severity of the symptoms that result from LDH, identifying effective modes of treatment are necessary. This thesis is examining the efficacy of chiropractic spinal manipulation as an effective mode of treatment for the LDH. In the next chapter, there will be a discussion of two chiropractic spinal manipulation techniques currently used as a method of treatment for LDH.

## CHAPTER 3

### Chiropractic Manipulation Techniques

Chiropractic techniques are currently being utilized clinically in an attempt to reduce and/or eliminate lumbar disc herniations and the complicating symptoms that arise. There have been several studies examining the efficacy of these techniques. In this thesis, the researcher will be examining two widely used techniques, which have also been the focus of chiropractic manipulation studies. In this chapter, an overview of the techniques will be presented. Additionally, the researcher will provide an explanation of the proposed mechanisms responsible for the alleviation of lumbar disc herniation. The techniques, which will be conveyed in this chapter, include flexion distraction and side posture manipulation (i.e., rotational manipulation).

#### Flexion Distraction Manipulation

Flexion distraction is a popular method used in an attempt to treat the lumbar disc herniation. According to a 1993 report by the National Board of Chiropractic Examiners, 53% of chiropractors report using flexion distraction manipulation, making it the third most frequently employed technique in chiropractic. Dr. James Cox who is a postgraduate instructor at National College of Chiropractic developed the Cox flexion distraction technique.

The following is a basic overview of the protocol referenced from Low Back Pain Mechanism, diagnosis and Treatment 6<sup>th</sup> ed. (p. 295) and Cox (1996):

The patient with true sciatic pain due to radiculopathy receives Cox distraction-adjustment protocol I. With this protocol the only adjustment the patient receives is intermittent flexion distraction with the Cox table. The patient is positioned prone

(Figure 7) and receives three 20-second sets of five distractive repetitions, each four seconds in duration, at the level of the diagnosed disc herniation. A 10-second interval of rest is procedure between each set of adjusting. The limit of downward motion of the caudal pelvic section will be two inches from the previous neutral starting point or that of patient discomfort. The patient is positioned prone on the adjusting table. A pillow can be placed under the abdomen or the caudal end of the table can be laterally flexed for patient comfort. Cox (1996) describes the procedure, "Axial flexed distraction is applied to the lumbar segment by contacting the spinous process superior to the segment to be distraction adjusted with the thenar eminence of the doctor's treatment hand."

Cox (1996) reports that the research has demonstrated the following effects of distraction adjustment: 1) an increase in posterior disc space height. 2) Flexion decreases disc protrusion and reduces central canal stenosis. 3) Flexion will pull the ligamentum flavum within the spinal canal taut thus reducing stenosis. 4) Flexion opens the vertebral canal by 2mm (16%) or 3.5 to 6mm more than extension. 5) Flexion increases metabolite transport into the disc. 6) Flexion opens the posterior facet joints thus reducing the stress placed on the posterior disc. 7) Intradiscal pressure will drop upon distraction and intervertebral foraminal openings enlarge providing patency to the exiting spinal nerve.

In theory, the lumbar disc is reabsorbed into its natural intervertebral space following flexion distraction. "Lumbar flexion produces relaxation of the anterior longitudinal ligament and stretch the supraspinal and interspinal ligaments; the ligamentum flavum and the posterior longitudinal ligament" (Barrale, Diamond, Filson & Wittmer, 1989, p.82). A stretching of the vertebral ligaments increases the intervertebral disc space, allowing more room for the herniated disc to recede back into its normal position. In order for the disc to be reabsorbed, the following mechanisms or

“phenomena” occur within the disc: 1) The disc space and apophyseal joint space open, allowing the herniated nucleus to be reabsorbed, as it migrates towards the center of the disc within the annulus. The anatomic structures of the lumbar area are opened. 2) A negative pressure (interdiscal) within the disc, created by the newly widened disc space, “sucks” the herniated disc back into place. 3) The posterior longitudinal ligament, which is attached to the posterior portion of the disc, is stretched and may “push back” the herniated disc into the disc space. 4) The intervertebral space is increased allowing the herniated disc greater space to migrate anteriorly into the anatomically correct position (Cox, Hazen & Mungovan, 1993). As seen in Figure 8, the applied +Z force attempts to influence the position of the displaced disc (Plaughter, 1993).

#### Side Posture Manipulation (Rotational Manipulation)

Cassidy, Thiel and Kirkaldy-Willis state, in their 1993 article, “the treatment of lumbar disc herniation by side posture manipulation is not new and has been advocated by both chiropractors and medical manipulators” (p. 98). Unlike flexion distraction, the purpose of side posture manipulation is not to manipulate the disc back into place. The adjustment is delivered in an attempt to restore proper biomechanical motion to the involved segment in order to reduce biomechanical and chemical stress. Side posture manipulation, is often implemented in conjunction with other techniques in order to increase joint flexibility, which in turn, will lead to an improvement in symptoms. Cassidy, Theil and Kirkaldy-Willis (1993) describe the overall effect of side posture manipulation as “...an increase in the active and passive range of joint motion and an improved therapeutic benefit and resolution of symptoms” (p.100).

Before manipulation, the patient is positioned on their side with their lower leg straight and the superior leg flexed at the hip and the knee (Figure 9). Prior to manipulation, the facet joint, or the motion segment, will be sent through its active and passive ranges of motion (ROM). Active ROM refers to the distance the individual can move their joint without assistance. Passive ROM refers to the normal joint motion beyond active ROM that requires an external application of force that does not surpass the elastic barrier. Active and passive ROM is achieved during side posture positioning (Figure 10). The chiropractor exhibits a counter rotation of the spine and pelvis, which causes a lateral flexion and rotation of the lumbar spine (Cassidy, Thiel & Kirkaldy-Willis, 1993).

During side posture mobilization, the lumbar spine is placed through its passive ROM motion. Passive ROM refers to the overall distance that the joint can move with external assistance. This is a therapeutic maneuver where the motion segment is taken back and forth through the passive ROM and can be seen in Figure 11. The purpose of mobilization, prior to manipulation, is to gently open and close the facet joint while stretching the surrounding muscles and ligaments (Cassidy, Thiel & Kirkaldy-Willis, 1993). Patient tolerance is important in order to proceed with side posture manipulation.

Once manipulation occurs, the joint is moved past its elastic barrier and into its paraphysiological space. The paraphysiological space refers to the joint moving beyond its active range of motion, causing a cavitation in the facet joint associated with a cracking sound. (Cassidy, Thiel & Kirkaldy-Willis, 1993). The chiropractor stabilizes the upper-torso while applying a low amplitude, high velocity thrust at the end of the passive ROM (Figure 12). According to Cassidy, Thiel and Kirkaldy-Willis (1993), this



procedure is responsible for producing a therapeutic benefit, as well as, an increase in the passive and active ROM.

The purpose of the side posture manipulation is to increase the flexibility of the facet joint while stretching the surrounding muscles and ligaments. The procedure can be administered upon a specific location in the spine, in an attempt to affect an individual intervertebral disc with a herniation. As seen in Figure 13, the maneuver can be localized by changing the amount of hip flexion. The chiropractor increases hip flexion to effect higher levels of the lumbar spine.

Barrale, Diamond, Filson & Wittmer (1991), describe two side posture adjustments for the treatment of LDH. The authors imply that there is uncertainty surrounding the forces placed on an already pathological disc during side-posture manipulations that require torque and/or flexion of the lumbar spine. They describe two side posture adjustments that are delivered with the spine in neutral. One adjustment, referred to as the pull through maneuver is utilized with the involved side down. The doctor contacts the anterior superior iliac spine with the adjusting hand while a superior traction is placed on the patient's shoulder and an inferior traction is placed on the patient's flexed thigh. A high-velocity, low-amplitude thrust is delivered from lateral to medial in attempt to produce a suctioning effect that is aided by a stretch of the anterior longitudinal ligament. The second adjustment is called a side-posture sacral ala adjustment and the patient is positioned with the involved side up. The doctor contacts the sacral ala while tractioning down on the patient's shoulder. A thrust is delivered in the anterior-medial direction in an attempt to produce the previously described "suctioning" of the disc. The thrust is held for 5-10 seconds for the paraspinal tissues to accommodate and the spine is not rotated during the adjustment. Barrale and others

(1991) state that these procedures are both safe and effective and can be used solely or in conjunction with a prone extension maneuver in the treatment of discogenic low back pain. They add that their testimony is based on clinical observation and the need for clinical trials regarding the efficacy of these procedures are necessary.

An inquiry into the effectiveness of a therapeutic procedure raises the question regarding the procedures safety. According to Terret and Kleynhans (1992), a survey of 406 *medical* practitioners performed 565,000 lumbar spinal manipulations. The following results were gleaned from the survey: 1:4,000 manipulations resulted in increased pain, 1:62,000 manipulations resulted in radicular pain, 1:1888,000 manipulations resulted in radicular symptoms and 1:565,000 manipulations resulted in cauda equina syndrome. Manipulative iatrogenesis in the lumbar region was more common when performed under anesthesia (44.6%), which is almost never performed in chiropractic clinics. The authors cited several studies that indicate that anesthesia increases the risk of injury from manipulation. In 13 cases (20%), the health care providers were chiropractors.

Haldeman and Rubinstein (1992) report that a review of the literature resulted in a total of 26 reported cases between 1911 and 1989 of cauda equina syndrome resulting from manipulation. In the literature, 16 of the 26 cases were manipulated under anesthesia, which the authors deem more vigorous and virtually abandoned. Only seven cases of cauda equina with a temporal association have been reported in North America. The authors cite statistics that chiropractors were estimated to receive 124 million patient office visits in 1975, which may be considered a median number of treatments delivered for the past 30 years. The authors extrapolate the following, "Even taking into account the potential for unreported cases, the incidence of such complications approaches one in many millions of treatments" (p.1471). They also state that since chiropractors perform

the majority of manipulations in the United States that it is not unexpected for the majority of complications to occur following chiropractic care. The authors conclude that, "Manipulation does not appear to be contraindicated in patients with disc bulging or herniation and is still widely prescribed and recommended for such patients" (p. 1472).

A prone lumbar extension adjustment procedure was discussed by Barrale, Diamond, Filson & Wittmer, (1989) and is discussed as a recognized alternative to the two chiropractic techniques evaluated in this thesis. The patient is placed prone on a table, which allows for a controlled degree of flexion. Direct manual contact is made on the spinous process of the vertebra, which is superior to the herniated disc and a thumb contact is placed in the disc space on the involved side. This permits for the shortest lever arm possible and a specific adjustment in the location of the problem. When adjusting the L5 disc the manual contact is made over the sacral ala on the involved side and the superior thumb is placed in the L5 disc space. The adjustment consists of a forward thrust in the +Z direction in an attempt to push the displaced nucleus anteriorly as seen in Figure 8 (Plaugher, 1993). A doctor, administering the adjustment, applies a force that is held for several seconds and followed by a gradual release since the creep properties of ligaments are time dependent. However, the researcher has not identified clinical research regarding the effectiveness of the prone manipulation procedure. At this time, the effectiveness of the prone disc adjustment is verified solely by anecdotal evidence passed on by doctors of chiropractic who utilize this technique.

### Summary

Flexion distraction and side posture manipulations are two chiropractic techniques, which are currently used for the treatment of lumbar disc herniations. Although the application of force varies in each maneuver, the expected effect is similar. Chiropractors anticipate a stretching of the ligaments and the muscles responsible for increasing the patients ROM. Both procedures are associated with an increased ROM and an alleviation of pain and other symptoms. The stretching of the longitudinal ligaments is associated with the centripetal effect and the reabsorption phenomena that occur after flexion distraction. This phenomenon is the mechanism which chiropractors claim is responsible for a herniated disc to recede to their normal position as a result of manipulation. Basically, the decrease in intradiscal pressure allows the nucleus to migrate back into the annulus, while the entire disc is suctioned back into the intervertebral space where it had protruded from earlier. The distraction technique is responsible for increasing the intervertebral space, allotting more room for the posterior bulge to migrate anteriorly.

The techniques discussed in this chapter can potentially be beneficial in the treatment of the lumbar disc herniation. The purpose of this thesis is to determine their effectiveness by reviewing current studies. In the next chapter, a review of the current research regarding the efficacy of chiropractic manipulation in the treatment of a LDH will be thoroughly investigated in order to provide insight on the topic. Effectiveness will be determined by the quantity of patients who have a decline in subjective symptoms, objective clinical exam findings, a clinical decrease in herniation and a low reoccurrence rate of herniation. The most important clinical outcome is the restoration of daily function such as returning to work.

## CHAPTER 4

### Review of the Literature

This chapter will provide an extensive overview of compiled current and past research regarding the research question: Are chiropractic spinal manipulation techniques an effective non-invasive treatment of lumbar disc herniations? Effectiveness will be determined based on the following criteria: 1) The number of individuals who have a decline in symptoms associated with LDH, 2) A clinically measured decrease in herniation, 3) Treatment must be sustained over time. The compiled literature consists of sample population studies, anecdotal studies or case studies, literature reviews, clinical reports and four classical studies. The acquired research will be presented in chronological order.

### The Studies

Lisi (2001) presented three cases of discogenic low back pain and leg pain in which the centralization phenomenon was used in determining chiropractic treatment and prognosis. The first case was a 61-year old who presented after referral with left low-back pain radiating to the posterior left thigh and calf and to the lateral aspect of the foot. Objective clinical examination findings were recorded and consistent with the presence of a LDH. Previous magnetic resonance imaging (MRI) demonstrated decreased hydration and disc bulges lateralized to the left at L3-4 and L4-5. A central subligamentous disc protrusion was evident at the L5-S1 spinal level. The patient underwent mobilization in the side posture position during the first four visits that centralized symptoms. On the subsequent three visits the patient received side posture manipulation. Following the sixth visit, the patient no longer used a cane, for the first

time in four months. On the eighth visit, low back pain was mild (1/10) and persistent but decreased parasthesia was present in the left thigh. Lumbar range of motion was full and did not provoke symptoms, as was the case upon initial examination. The patient was able to return to work without restrictions and was seen for follow-up twice over the next four months without any significant exacerbations.

The second case reported in Dr. Lisi's 2001 case report was a 36-year old patient. The patient presented with subjective and objective clinical findings consistent with a LDH. An MRI confirmed annular tears at L2-3, L3-4 and L4-5. At L5-S1 a broad based posterior central disc protrusion was evident indenting the central portion of the thecal sac. On the first visit, the patient was treated with provocation mobilization in the side posture position that centralized symptoms. On the next day, the patient was adjusted in the side posture position with the spine in extension and reported a significant decrease in leg pain and low back pain immediately after the procedure. The patient received similar adjustments 3 more times over the next week, at which time his subjective pain was completely resolved. The patient was seen periodically over the next 14 months for minor recurrences of low back pain without any exacerbation of leg pain.

Lisi (2001) discussed a third case that presented with right low back pain and right leg pain of gradual onset over the past two weeks. The patient was 37 years old and objective findings were consistent with that of LDH. MRI confirmed the diagnosis of disc protrusion and sequestration at the L4-5 level and L5-S1 level and the patient was co-managed with pain medication from his primary care physician. The patient received side-posture mobilization and manipulation as well as postural and exercise instructions. The patient's symptoms failed to centralize and he underwent microdiscectomy at both involved spinal levels. In summary, the two patients whose pain could be made to

centralize upon provocation had excellent outcomes to chiropractic side posture manipulation. The one patient, who required surgery, had pain that peripheralized upon provocation and had multiple free fragments that were confirmed by MRI.

Drs. Larry Swank and Julie A. Schard (2001) reported successful results utilizing Cox flexion distraction on a patient who presented with a LDH at the L4 and L5 spinal levels. The authors noted that, “this particular case described an atypical presentation due to the L5 disc affecting two nerve roots, L5-S1, via protrusion into the neuroforamen of L5-S1” (p.39). Flexion distraction technique was utilized over a 12-week period. The authors reported that the patient experienced immediate relief of symptoms. Outcome measures were determined through the utilization of a visual analog scale. The patient experienced a decrease in low back and buttock pain by 50% within the initial week of care. The patient was able to return to work by the end of two months of care.

Dr. Gert Bronfort and others (2001) conducted a pilot study for a randomized clinical trial in order to study the non-operative treatments of sciatica. The study participants were those patients’ ages 20 to 65 years, with low back-related radiating leg pain or sciatica. Outcome measures were determined in the form of self-report questionnaires.

The first of the three randomized groups was a medical care group whose treatment consisted of prescription NSAIDs, acetaminophen, mild narcotic medication, self-care instructions and activity modification. The second group received epidural steroid injections. The third group was the chiropractic care group and treatment consisted of “spinal manipulation, with light soft-tissue massage and /or traction with the assistance of a flexion distraction table...” (p.538). The chiropractic manipulation was not specified since the patients were adjusted with a high-velocity, low-amplitude thrust

in either the prone, supine or side-lying position. All randomized patients received two 45-minute self-care classes with a physical therapist.

The authors reported that the cost of care was \$800 for medical care, \$550 for chiropractic care and \$1700 for those patients who received injections over a 12-week period. The authors reached the following conclusions: "All three groups showed substantial improvements in the main patient-rated outcomes at the end of the 12 week intervention phase. For leg pain, back pain, frequency and bothersomeness of leg symptoms, and the Roland-Morris disability score, the improvement ranged from 50%-84%" (p.541). Unfortunately, the researchers did not perform a between-group comparison because of the insufficient sample size and the high risk of committing statistical error. Furthermore, the researchers concluded that recruitment for a full-scale population of sciatica patients suffering for only 2-12 weeks duration is not feasible. Instead, a future pilot study was planned with sciatica patients who have been experiencing symptoms for more than 4-weeks duration. Additionally, the medication group will be replaced with a self-care advice group.

The following study conducted by Burton and others (2000) served as a comparative analysis of chemonucleolysis and osteopathic manipulation in the treatment of symptomatic lumbar disc herniation. The researcher decided to include this study in the literature review for two reasons: a) single-blind randomized clinical trials are virtually non-existent in the literature b) the methods of osteopathic manipulation in Europe are very similar to chiropractic manipulation performed in the United States. The researcher realized that a correlative assumption has been made in the above statement and the research that is being presented will not be utilized in determining the efficacy of chiropractic manipulation in the treatment of the LDH.



Osteopathic manipulative treatment consisted of 15 minute sessions that included stretching of the lumbar and buttock musculature, low amplitude passive articular mobilization of the lumbar spine, and the use of high-velocity, low-amplitude thrusts to one or more of the lumbar motion units (Burton 2000). The study did not reveal the patient set-up or frequency of manipulations. Forty patients diagnosed with sciatica confirmed through imaging were treated either by chemonucleolysis or manipulation. Outcomes were measured at 2 weeks, 6 weeks and 12 months. Outcome measurements consisted of leg pain, back pain and self-reported disability. The mean values for all outcomes improved in both groups. At the end of one year, there was no statistical difference in outcome for either group, however manipulation produced a statistically significant greater improvement in back pain and disability in the first few weeks. A cost analysis revealed an overall financial advantage in the manipulation group. The chemonucleolysis group served as a control group that was deemed to be an effective treatment. Nevertheless, since manipulation produced comparative results the authors concluded that manipulation is considered a safe and effective treatment of symptomatic LDH.

Crawford and others (1999) discuss a case that initially presented as mechanical low back pain that evolved into radiculopathy. The patient was a 35-year old male who presented with unilateral low back pain and nonradicular/nonlancinating referral to the ipsilateral lower extremity. The authors stated that disc herniation in evolution was included in the working differential diagnosis and the patient gave verbal informed consent prior to manipulation. Side posture manipulation was performed on the lumbar spine and sacroiliac joints that were determined to be dysfunctional. Eight days later the patient presented with subjective and objective clinical findings consistent with the

presence of a LDH. A CT examination was ordered and confirmed the diagnosis with disc protrusions at the L4/5 and L5/S1 spinal levels. Side posture manipulation was continued at this point in the case. Over the course of several weeks of care, the patient's subjective symptoms of low back pain and lower extremity pain had resolved. Objective clinical findings that were positive initially were deemed negative upon re-examination including but not limited to SLR and muscle testing of the lower extremity. The left Achilles reflex remained minimally reduced in comparison with the right. A second CT examination was performed which demonstrated a reduction in size of the L5/S1 disc protrusion with less mass effect on the adjacent left S1 nerve root sheath. No change was recognized in the size of the L4/5 disc protrusion. The authors suggested that lumbar spine manipulation may not necessarily be contraindicated in cases of LDH with neurological deficit and nerve tension signs (p. 242). Crawford and Hannan (1999) conclude, "The role played by manipulation in treating patients with disk herniation (and low back pain) may lie in the alleviation of associated back pain and therefore may be justified as an intervention in patients with concomitant lumbar disk herniation and low back pain" (p. 241).

Morris (1999) examined a "multimodal" chiropractic rehabilitation strategy for the potential benefit for a patient diagnosed with lumbar radiculopathy associated with LDH. A 31-year old male presented with clinical findings of S1 radiculopathy that was later confirmed by MRI. Treatment consisted of mobilization, side-posture manipulation, flexion-distraction, counseling/education, muscle relaxation techniques, proprioceptive training, trunk stabilization and conditioning exercises. Flexion distraction was added to the patient's treatment regimen on the fourth visit since it did not produce peripheralization while side posture manipulation was not performed until the 13<sup>th</sup> visit.

The patient was able to return to modified work 27 days after symptom onset. A follow-up comparative MRI did not show any reduction in the herniation. The patient was discharged from care as asymptomatic when he had a zero rating on both Oswestry and numerical pain scales after 50 days and 20 visits. Additionally, motor strength returned to normal, although the left S1 reflex remained absent. Lumbar range of motion was full and pain free and gait was normal. Reassessment after 169 days revealed neither symptoms of radiculopathy nor lifestyle restrictions. Clearly, the “multimodal” approach including rehabilitation incorporated with chiropractic manipulation was effective in the treatment of LDH in this case. However, in the “multimodal” approach, a definitive conclusion regarding the role and effectiveness of spinal manipulation in the favorable outcome of this case cannot be determined.

Crawford (1999) presents a case of a 36-year-old mother with two children who presented with low back pain, sharp leg pain and numbness in her toes. A CT scan indicated a central left disc herniation at the L5-S1 spinal level. The herniation was abutting the ventral portion of the thecal sac and the left S1 nerve sheath. Treatment consisted of nine therapy sessions over a three-week period. Treatment consisted of 4 physiotherapy modalities for pain management along with chiropractic manipulation. Manipulation of the lumbar spine and sacroiliac joints was done with the patient in the side posture position. Finally, flexion distraction was performed with an L5 spinous process contact in a cephalad direction in order to effect the desired spinal segment. The authors report that the patient improved with each session. Following the 9<sup>th</sup> session, the patient terminated care since she felt that she reached maximal improvement. No long-term follow-up was reported.

Troyanovich and others (1999) conducted a review of the literature regarding low back pain and the lumbar intervertebral disk. They reached a conclusion that:

“Of the available treatments, chiropractic management has been shown through multiple studies to be safe, clinically effective, cost-effective, and to provide a high degree of patient satisfaction. As a result, in patients with discogenic or radicular pain syndromes for whom surgical indications are not absolute, a minimum of 2 to 3 months of chiropractic management is indicated” (p.102).

The authors also stated that both conservative and surgical procedures have both been shown to effective in management of discogenic and radicular pain syndromes.

However, they feel that conservative treatment should be utilized as the first line of defense in those patients without cauda equina syndrome, severe motor deficits and/or intractable pain.

A case study presented by Bergmann (1998) exemplifies the success of flexion distraction utilized in conjunction with side-posture manipulation for the treatment of an L4-L5 disc herniation. Protocol I was applied to the patient's L4-L5 segment and the patient was instructed to ice at home. Additionally, the patient was told to lie on her back at home with her knees and hips bent to 90 degrees in an attempt to flatten the normal extension of the lumbar lordosis. One week later, her subjective complaint of LBP was almost gone and her leg pain no longer bothered her. Chiropractic treatment consisted of flexion-distraction, long axis distraction of the lower extremity and side-posture manipulation.

Beira and Peers (1998) studied the effects of both side posture manipulation and flexion-distraction on the diameter of the spinal canal in patients with CT confirmed LDH. The purpose of the study was to determine if chiropractic manipulation reduced the

size of the LDH (or increased canal size) and determine if there was a relationship between changes in disc size and patients perceived pain. Two management groups consisting of 15 patients were created. One group received chiropractic side posture manipulation and the other group underwent flexion distraction. Patient assessment consisted of recognized orthopedic and neurological tests; a numerical rating scale 101 and Oswestry back disability indices. A CT examination was performed at multiple levels to confirm and measure the size of LDH and a repeat investigation was performed at the conclusion of treatment at those levels that were previously determined to be pathological. Disc lesions were found at the third, fourth and fifth lumbar levels with the greatest occurrence at the L5 spinal level. There were thirty-eight intervertebral discs that displayed pathology prior to chiropractic care.

Beira and Peers (1998) noted that, "objective and subjective criteria for the measurement of patient discomfort showed statistically significant improvements for both treatment procedures" (p. 114). Neither procedure was found to be statistically more favorable for the management of the patient's symptomatology. However, the side posture manipulation group achieved asymptomatic status more rapidly than the flexion-distraction group. Post-treatment CT demonstrated an increase in the percentage occupancy of the spinal canal by a LDH in 10 cases. However, twenty vertebral levels showed a decrease in the percentage of occupancy in the central spinal canal due to a LDH. The mean percentage of central canal occupancy in the side-posture manipulation group prior to treatment was 30.98%. Post-treatment tomography revealed occupancy of 26.29%. The mean percentage of central canal occupancy, prior to care, for the group of patients treated by flexion-distraction was 33.51%. The post treatment CT examination revealed that the mean occupancy was reduced to 29.28%. Although there was a

reduction in canal occupancy, the percentages were not found to be statistically significant for either group. The authors concluded, "reduction of the objective and subjective clinical presentation, without significant changes in the intervertebral disc to spinal canal ratio, leads to the conclusion that neither the presence nor the size of the intervertebral disc following lumbar spine radiological examination should be used as pathological indicators" (Beira and Peers, p.114). However, the authors did note that chiropractic examination and treatment of lumbar spine pain with radiculopathy displayed qualities of being both safe and effective.

Guadagnino (1997) discusses the success of Dr. James Cox in the treatment of a patient with a proven disc herniation. The researcher also states that the flexion-distraction procedure is a therapeutic alternative that may offer relief of subjective complaints and objective findings. He adds that the success of the technique may spare the patient from surgery.

Blue Cross and Blue shield of Ohio in collaboration conducted a clinical study with *Physician's First* (1996), an established chiropractic clinic. The purpose of the study was to determine the effectiveness of chiropractic as a viable treatment of back injuries that would otherwise require a surgical intervention. The subjects consisted of 10 patients who were all diagnosed with intervertebral disc syndrome. All 10 subjects had received medical treatment for the above diagnosis. The subjects were treated with the utilization of the Cox flexion distraction technique for a 12-week period. Post-treatment surveys were administered and revealed that all 10 patients reported subjective improvement in the frequency and severity of symptoms.

In a 1996 investigation of 1,000 low back pain patients, Dr. James Cox reported significant results regarding the effectiveness of flexion distraction for the treatment of

the LDH. Dr. Cox utilized two separate studies, (Cox and Shreiner 1984) and (Cox and Feller 1994), that utilized identical data collection methodology. The results of these studies were used to perform a critical analysis on the efficacy of flexion distraction on the LDH. Flexion distraction was utilized in 92% of the cases in addition to physiotherapy modalities, bracing and exercises. The study examined the number of days to reach maximum improvement and the number of treatments to reach maximum improvement. Maximum improvement was defined as, "...either at 3 months of conservative care, the reestablishment of the pre-care injury state, or 100% relief of pain" (Cox 1996, p.57-8). Of the 1,000 cases, 89 presented with an L4 disc herniation and 111 presented with an L5 disc herniation. For the purpose of this review, the researcher will focus on the results of these cases. Disc herniation at L4 and L5 responses produced 60.7% and 65.8% good to excellent responses, respectively. Furthermore 86% of the patients with an LDH reached maximal improvement in less than 90 days of care. 70% of the patients with either an L4 or an L5 disc herniation reached maximum improvement in 30 visits or less. (Figure 14 and 15)

In a 1996 study, BenEliyahu performed a study of 27 patients receiving chiropractic care for disc herniations. Treatment consisted of a combination of flexion distraction, side posture manipulation and therapeutic exercise. The following criteria were used to define a good clinical outcome: 1) Improved visual analog scores (VAS, patients rate their pain on a scale of 0-10, no pain to excruciating pain; scores needed to be 2 or less) 2) Resolution of referred extremity pain or paresthesia 3) Improved clinical findings (i.e., stretch tests, ROM, sensory findings). A positive MRI scan for LDH at the initiation of treatment was compared to a MRI done after 9 months. All of the 27 subjects were out of work as a result of their condition.

BenEliyahu (1996) reports that 22 of 27 (80%) had a good clinical outcome. Of the 22 patients with a good clinical outcome, 17 also had evidence of a reduced or resolved disc herniation upon repeat MRI scanning. There were six cases of nerve root compression seen initially on the MRI scans, of which five (83%) completely resolved. There was a 73% overall reduction in reported pain by VAS. The average VAS pre-treatment was 6.9 (moderate-intense pain), compared to an average VAS of 1.9 (low pain) after treatment. Of the 27 patients, 21 were able to return to work one year later, suggesting there is a long-term effect of treatment. BenEliyahu (1996) concludes, “the case series of 27 patients proposes that chiropractic manipulation may resolve disc herniations both clinically and anatomically” (p. 605).

Stern and others (1995) reviewed the charts of 3,553 consecutive patients presenting to a postgraduate teaching clinic. In 71 of the cases, the patients had low back pain with radiating leg pain that was diagnosed as a LDH. Outcome measures were determined as subjective improvement, range of motion and the straight leg raiser test which tests nerve root tension over a disc bulge. Of the 59 patients who received chiropractic care, 90% reported subjective improvement. Of the 90% that reported improvement, 75% had an increase in straight leg raising and lumbar range of motion. The maximum complication rate associated with the treatment was estimated as 5% or less. The study also revealed that a previous history of low back surgery was a statistically significant predictor of poor outcome. The patients in this retrospective study were treated with side-posture manipulation (93%) and interferential current (97%). Seventy-eight percent of the cases were instructed on how to perform William’s exercises. The authors postulated, that a course of non-operative treatment that includes



manipulation might be effective and safe for the treatment of back pain complicated by radiculopathy.

In Cassidy, Thiel and Kirkaldy-Willis's, 1993 literature review, they state they had observed 14 patients who had a CT confirmed lumbar disc herniation. All subjects were undergoing side posture manipulation for treatment. After a two to three week period, 13 of the 14 patients had a significant clinical improvement and relief of pain. Treatment focused on increasing the mobility of the spine and reducing inflammation associated with pain. Cassidy, Thiel and Kirkaldy-Willis (1993) concluded, "the treatment of lumbar intervertebral disc herniation by side posture manipulation is both safe and effective" (p.102).

Hession and Donald (1993) studied a high school football player (16 years old) who was experiencing a gradual onset of low back pain after performing power squats in the weight room. Magnetic resonance imaging revealed that there were central posterior disc herniations in the lower three levels of the spine (L3-L4, L4-L5, L5-S1). Flexion distraction, rotational manipulation and electrical stimulation to the paraspinal muscles provided a quick improvement and a long-term resolution of the associated symptoms. Previous symptoms included low back pain, muscle spasm and abnormal tightening of the hamstrings. Visual analog pain scales were used to measure the effectiveness of the treatment. The patient's initial VAS was 9.2 (intense and disabling), 7.4 at the end of week three, 5.8 at week four, 4.1 at week five and 2.7 at the end of week six. At the end of the eighth week, the patient reported no pain. In addition, his ROM was completely restored and he experienced no muscle spasms. His long-term status was determined after 16 months. At that time, he had not reported any problems and had returned to

football using a modified strengthening program. This study reveals the longevity of the treatment.

Cox, Hazen and Mungovan performed a case study, in 1993, on a 38-year-old female who had a CT confirmed L5-S1 and L4-L5 disc herniation. Her associated symptoms included low back pain, right lower extremity pain and sciatica. Flexion distraction manipulation was the primary treatment and was used in conjunction with extension, lateral flexion, rotation and circumduction manipulation movements and extension exercise to strengthen the lumbar muscles. The patient began treatment in May and the follow-up CT was performed in September. By September, the CT scan revealed a seven percent reduction in the herniation (Figures 16 and 17). The herniation, which previously engulfed 40% of the interneural canal, was reduced to 33% by September. Additionally, the patient was asymptomatic with a complete relief of sciatica and back pain. Within their article, Cox, Hazen and Mungovan (1993) refer to a study of 64 herniated lumbar disc patients, confirmed by a CT scan. The study revealed that 90% achieved a good to excellent outcome and 92% returned to work following their non-operative care.

Boazzo and others (1992) performed a study on 69 patients who had lumbar disc herniations proven by magnetic resonance imaging. All the patients reported lumbar pain and underwent spinal manipulation. Of the 69 patients, four had new herniations at a different level and were excluded. The disc herniations were postero-lateral in 36 cases, medial in 21 and eight cases involved the neural foramen. A follow-up MRI was given 8- 12 months after the initial treatment. Thirty-one (48%) individuals had a reduction in LDH higher than 70%, 10 (15%) had a reduction of LDH of 30-70% and 19 (29%) showed no reduction at all. An example of LDH reduction by use of MRI can be seen in

Figures 18. Although many of the previously discussed studies focus on relief of pain and increased function, this study shows the long-term effects that spinal manipulation can have on reducing a herniation. Boazzo and others (1992) state that the study revealed that the patients undergoing the non-surgical treatment experienced, "...a high frequency of regression of herniated material and a low frequency of progression of the disease" (p.140).

In a case study administered by Neault (1992), a 58 year-old female was diagnosed with L4-L5 left nuclear disc herniation and prolapse. CT and MRI initially verified her diagnosis. The patient was in distress each day, her pain exacerbated while sitting and leg pain leading to her toes. She exhibited a limp and experienced muscle spasms. Treatment included flexion distraction manipulation used in conjunction with exercise, lumbar support and nutrition. The patient was asymptomatic four weeks after treatment. Equally important, an MRI verified a decrease in the protrusion in the neural canal six weeks after the initial imaging. After an 11-month follow-up, the patient no longer reported incidences of the original condition and all objective findings were negative. Neault feels that the manipulation administered in this study could have been responsible for the reduction of the LDH to a tolerated level.

Husbands and Pokras (1991) report a case of an L5-S1 herniation with an atypical presentation. The patient was a 24-year-old hyperkyphotic male who presented with marked right antalgia and severe pain. Radiographic examination revealed an L6 vertebra with hypoplastic (underdeveloped) lumbosacral articular facets and spina bifida occulta. The patient also had radicular compression upon physical exam. He was treated with flexion-distraction with a significant decrease in symptomatology. The significance

of this case is that flexion distraction may be helpful in the treatment of radiculopathy complicated by congenital instability.

In a 1991 article, Hubka, Taylor, Schultz and Traina report a case study of a 28-year old male dancer who was diagnosed with an L5-S1 herniation associated with muscle and joint dysfunction. An MRI revealed a medial and lateral lumbar disc herniation. The imaging also showed that the nucleus was contained within the annular fibers medially, however, the nucleus was not contained laterally as it extended through the annular fibers. The medial herniation was placing pressure on the S1 nerve root. Chiropractic care was administered twice a day for sixteen days with the objectives of pain relief, restoring function and prevention of recurrence. A combination of flexion distraction, rotational manipulation and extension exercises were administered over the course of treatment. The patient began to experience a relief of pain and increased lumbar functioning with respect to flexion and rotation. A follow-up, six months later, revealed that the patient had no recurring pain and had returned to his full dancing capacity. Hubka, Taylor, Schultz and Traina (1991) attribute the relatively short response time to the selection and frequency of the manipulative treatment, patient motivation and participation. Additionally, they state that their clinical experience suggests that flexion distraction and extension manipulations may be as effective as rotational manipulation in the treatment of LDH.

Onel and others (1989) were able to show the positive effects of distraction with CT scanning. Their study showed that distraction reduced 78.5% of medial, 66.6% of postero-lateral and 57.1% of lateral disc herniations. Clinical findings in 28 of 30 (93%) cases of LDH were found to improve. They proposed that the distraction caused a regression of the herniated nucleus by tautening of the posterior longitudinal ligament to

“push back” the herniated disc material. In addition, a suction force of negative intradiscal pressure is created through distraction in order to pull the disc back into its proper anatomical position.

Quon, Cassidy, O'Connor and Kirkaldy-Willis (1989) administered daily side posture manipulation and flexion exercises to a 30-year old patient suffering from a L4-L5 herniation confirmed by a CT scan. After one week, the back pain had disappeared and after two weeks, his leg pain had improved considerably. His straight leg raising ability, strength and deep tendon reflexes were all within the normal range. A follow-up examination was administered three months later. It revealed that the man was still asymptomatic. The man continued to improve when tested with the straight leg raising test on his last reassessment six months later. Quon, Cassidy, O'Connor and Kirkaldy-Willis (1989), report their findings as evidence that rotational manipulation can resolve a lumbar disc herniation.

In a 1987 article, Cox and Aspergen discuss a method of calculation for discal reduction on CT scan. Drs. Cox and Aspergen presented a case with a 14% reduction of a disc protrusion following flexion-distraction manipulation as measured on CT scan before and after care. They also noted that a less than complete reduction in total disc herniation resulted in total relief of sciatica in this patient.

Dr. James Cox (1985) published a case report regarding the effective treatment of a lumbosacral disc protrusion utilizing the flexion-distraction procedure. The case consisted of a 36-year old male who presented with low back pain and left leg pain. The patient was previously treated with epidural steroid injection and physical therapy for five months prior to chiropractic care. A customary orthopedic and neurological examination was performed and consistent with a LDH. The LDH was confirmed at the L5-S1 level

by CT examination. The patient's treatment consisted of flexion distraction manipulation twice daily. Physical therapy modalities in the form of positive galvanism, tetanizing current and alternating hot and cold packs to the low back and left lower extremity were utilized. Treatment was conducted twice per day for one week. At the end of 6 weeks of care, the patient returned to full work duties as a truck driver. The patient's orthopedic and neurological examination was negative for the symptomatic presentation of LDH. In this case, the patient had been treated for over three months prior to successful chiropractic care. According to Cox, in this case, chiropractic care demonstrated faster results, less disability, less office visits and lower cost.

There were four classical studies that are significant to the topic and are cornerstone studies, referred to in much of the current research. The researcher feels that these studies are noteworthy despite their age because of the large scale of patients studied. Kuo and Loh (1987) studied 517 patients from 1975 to 1983 who received traction and rotational manipulation for an LDH. The longitudinal study revealed that acceptable results (relief of pain and lessening of the symptoms) were achieved by 397 (76.8%) of the patients with only 73 of 517 (14.1%) experiencing a recurrence in symptoms. The researcher notes that although Kuo and Loh utilized rotatory manipulations, they used eight types of manipulation and they felt distraction should be used prior to any manipulation.

Yefu, Jixiang, Zuliang and Zhenqian (1986) performed another large-scale classical study. This study examined 1,455 cases of protruded lumbar discs that underwent Chinese manipulative reduction similar to western chiropractic techniques. There was resolution of the radiating lumbar leg pain in 891 cases (61.2%) and they were able to return to work. Also, 257 (17.7%) patients deemed the treatment "remarkably

effective” and were able to return to work at least of a lesser load. The remaining 242 (16.6%) showed improvement but were not able to return to work.

Nwuga (1982) conducted a randomized control study on the efficacy of vertebral manipulation and conventional treatment for 51 patients diagnosed with LDH. This study has been cited in much of the literature and has been included in this review even though the manipulative treatments were not administered by a chiropractor. The study participants were females with ages ranging between 20 to 40 years of age. They all presented with low back pain and unilateral leg pain or numbness. Disc protrusion had been confirmed in all the patients after clinical investigations, which included myelographic and electrodiagnostic studies. The patients were alternately placed into a conventional treatment group and a manipulative therapy group. The conventional treatment group received 20 minutes of short-wave diathermy followed by gentle isometric exercises of the abdominals and back muscles. The therapist also educated the patients on posture and proper lifting mechanics. The manipulative therapy group was treated with lumbar oscillatory rotation. This technique can be described as a side posture manipulation, as described above, however the author makes no reference to a high-velocity, low-amplitude thrust. The patient was positioned in the side posture position and the lumbar spine was mobilized into rotation to the point of pain. The therapist’s hand was placed over the patient’s superior buttocks and the patient was instructed to push against resistance and relax while the therapist stabilized the patient’s uppermost shoulder. Treatment consisted of a three visit per week schedule and after six weeks and a neutral assessor assessed each patient.

The results of the Nwuga (1982) study revealed significant differences in post-treatment total flexion and extension, total side-flexion, lumbar rotation and straight leg

raising test in favor of the manipulation group (Nwuga, p. 275). Nwuga concluded that, “manipulation therapy as shown by this study was found superior to the conventional method in the treatment of the type of patients described [those patients with lumbar disc protrusions]” (p.277). The author added that manipulation therapy was superior to the conventional method described in this study. Nwuga referred to a study conducted by Henderson (1952), in the *British Medical Journal*, and noted that out of 500 patients treated with manipulation, over 50% were relieved of pain or improved. While another group, treated with heat and rehabilitation did not improve.

Lastly, Chrisman, Mittnacht and Snook (1964) reported the results of rotary manipulation on 39 patients with a ruptured intervertebral disc. The results revealed that 21 of 39 patients (57%) had received good to excellent results, which included relief of back pain and no objective findings. These classical studies are relevant because they provide further insight about the topic. These studies are of a large scale or, in the case of Kuo and Loh (1987), longitudinal. They may provide valuable information regarding long-term effects and the possible generalizability of the smaller studies.



### Summary

This chapter has thoroughly presented the recent literature that has addressed the effectiveness of flexion distraction and side posture manipulation for the treatment of LDH. The studies provide a comprehensive look at patients with clinically confirmed lumbar disc herniations who suffered from the associated symptoms. A relief of pain, an increase in lumbar and extremity function, return to daily activities and/or an objective reduction in the size of the herniation following manipulation determined patient improvement. The majority of the studies performed a follow-up examination to insure that the condition had not reoccurred in the treated patients. The presented research provides useful insight regarding the efficacy of chiropractic manipulation as a treatment for LDH. In the next chapter, the researcher will discuss the compiled literature and attempt to resolve the research question.

## CHAPTER 5

### Conclusion

The purpose of this thesis was to examine the research question: Are chiropractic spinal manipulation techniques an effective non-invasive treatment of lumbar disc herniations? The researcher attempted to resolve the research question by amassing the current literature on the topic and used a critical analysis research methodology to analyze the information. A total of 26 studies that addressed the effectiveness of flexion distraction and/or side posture manipulation for the treatment of LDH were found. All of these studies were administered within the last eighteen years and published in peer-refereed journals. Of the 26 studies reviewed, 26 had positive results regarding the effectiveness of chiropractic manipulation in the treatment of LDH. The effectiveness of the manipulations was measured by: 1) A reduction or elimination in the herniation size, confirmed by CT or MRI. 2) A decrease in the associated subjective symptoms, including a return to normal activities of daily living 3) A decrease in objective findings including examination and diagnostic imaging 4) Treatment effects must be sustained over a significant amount of time. All outcomes of the reviewed studies fulfilled the above criteria either partially or in whole. Some of the authors did not report on case follow-up and conclusions regarding the long-term outcome of those cases cannot be assumed. Based on a preponderance of evidence, the researcher concludes that the flexion distraction and side posture manipulative techniques are potentially effective non-surgical treatments for the herniated lumbar disc.

Further research is needed in the area in order to draw a more definitive conclusion. Much of the positive research is anecdotal; nevertheless, larger scale studies

that examine the treatments are needed. The clinical success presented in this paper has merit with respect to the effectiveness of chiropractic technique. However, the case studies cannot be generalized to large populations. Further, controlled investigation is warranted before an absolute determination can be reached on the efficacy of chiropractic treatment. Unfortunately, a double blind study is very difficult to perform since the doctor administers the treatment. Additionally, more longitudinal studies need to be performed that examine the effectiveness of the treatment past a year. Unfortunately, the chiropractic research machine lacks the funds and resources that other professions may have. Nevertheless, there are a large enough number of chiropractic colleges and active practitioners who can design valid studies to substantiate much of the already proven anecdotal data. New research regarding the effectiveness of chiropractic manipulation in the treatment of a LDH has been minimal since 1999.

The techniques discussed in this thesis were proven successful when utilized together and in conjunction with therapeutic exercises, physiotherapy modalities as well as other manipulative techniques. Future studies need to be randomized and controlled to test for the effectiveness of each technique by itself and in comparison to other avenues of conservative care. Chiropractic is a healing art and every practitioner delivers the adjustment with slight variations even when performing the same technique. Future research may encounter some difficulty since the consistency of the chiropractic adjustment is hard to reproduce and control for. Currently, based on the presented research, the researcher concludes that the presented chiropractic techniques are effective conservative treatments of the LDH. However, the research supports that the techniques are adventitious when used in conjunction with physiotherapeutic modalities and rehabilitative exercise.

Many Americans live with back pain for fear of surgery and a vast number elect surgery in order to treat an LDH. Furthermore, the effectiveness and necessity of surgical treatment of an LDH is controversial. Identifying a beneficial non-surgical treatment is of major importance for the public and health professionals. Although many health professionals refer patients with LDH to a chiropractor based on anecdotal evidence, there are those that will require large population, longitudinal randomized and controlled evidence to base their clinical judgments. Additionally, the cost of treating lumbar disc disorders with chiropractic has been shown to be lower than medical intervention (Schmidt 1992). This thesis provides evidence that chiropractic spinal manipulation can be an effective non-invasive treatment of the herniated lumbar disc and may be most effective when used in combination with physiotherapy.

THE SPINE

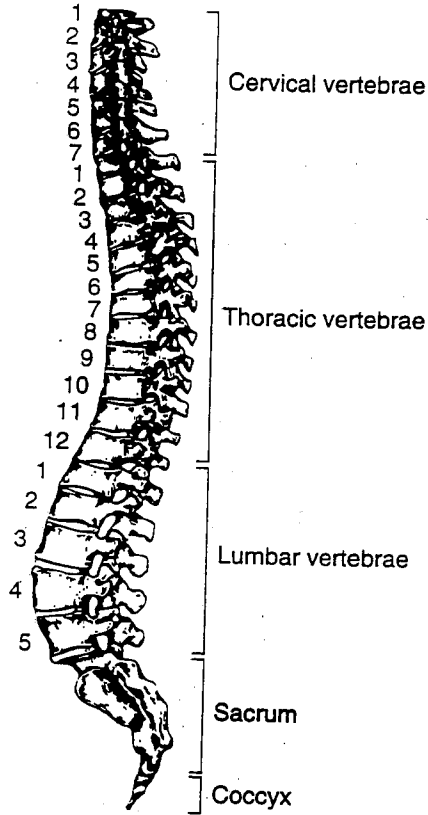


Figure 1. Side view of the vertebral column.

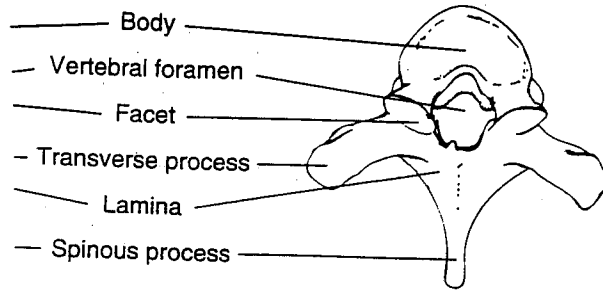


Figure 2. Typical parts of a vertebra.

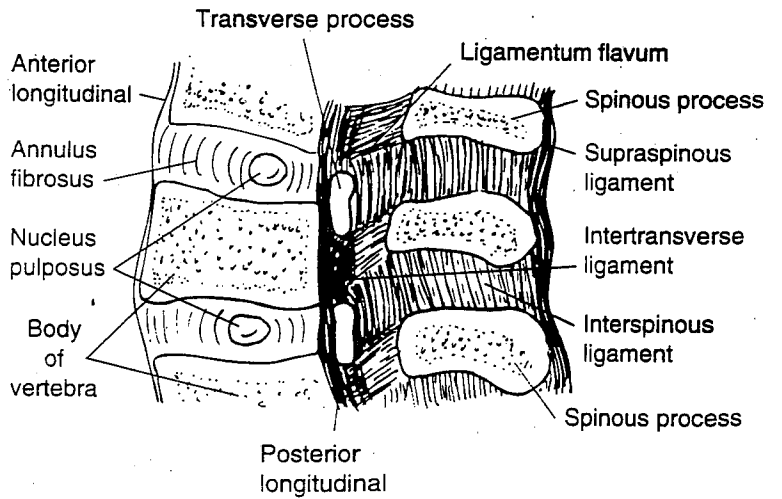


Figure 3. Sagittal cross section of the vertebral column and ligaments.

Source: Kreinbaum, E., & Barthels, K. (1996). Biomechanics, 4<sup>th</sup> ed. Boston: Allyn and Bacon.

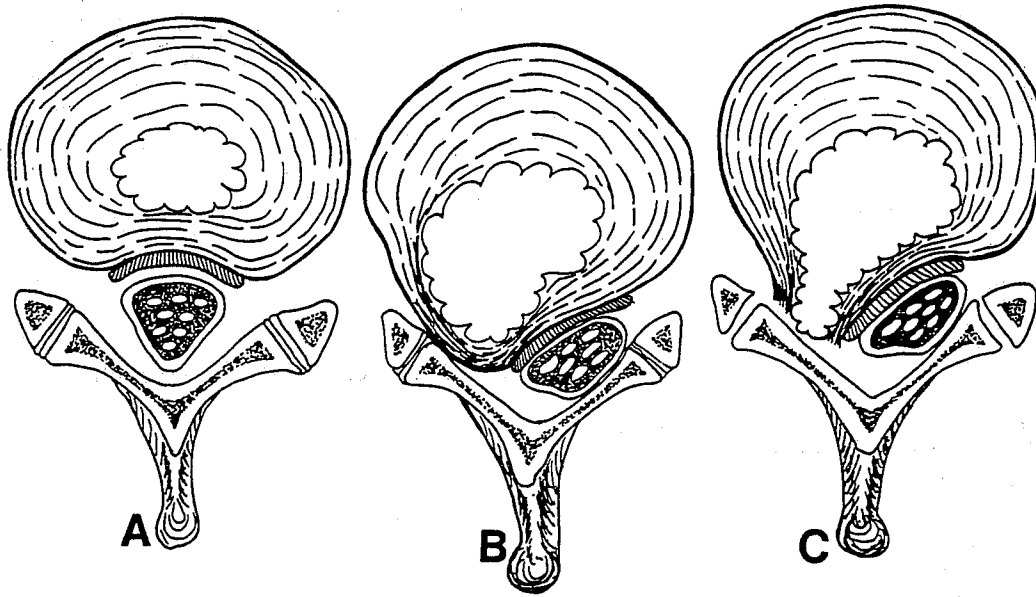
LUMBAR DISC HERNIATION

Figure 4. Schematic diagrams illustrating: A. Normal axial anatomy of a lumbar disc. B. Contained disc herniation with no extension of the nucleus beyond the annular fibers or the posterior longitudinal ligament. C. Non-contained disc herniation extending beyond the outer annular fibers.

Source: Hubka, M.J., Taylor, J.A., Schultz, G.D., & Traina, A.D. (1991). Lumbar intervertebral disc herniation: chiropractic management using flexion, extension, and rotational manipulative therapy. Chiropractic Technique, 3,(1), 5-12.

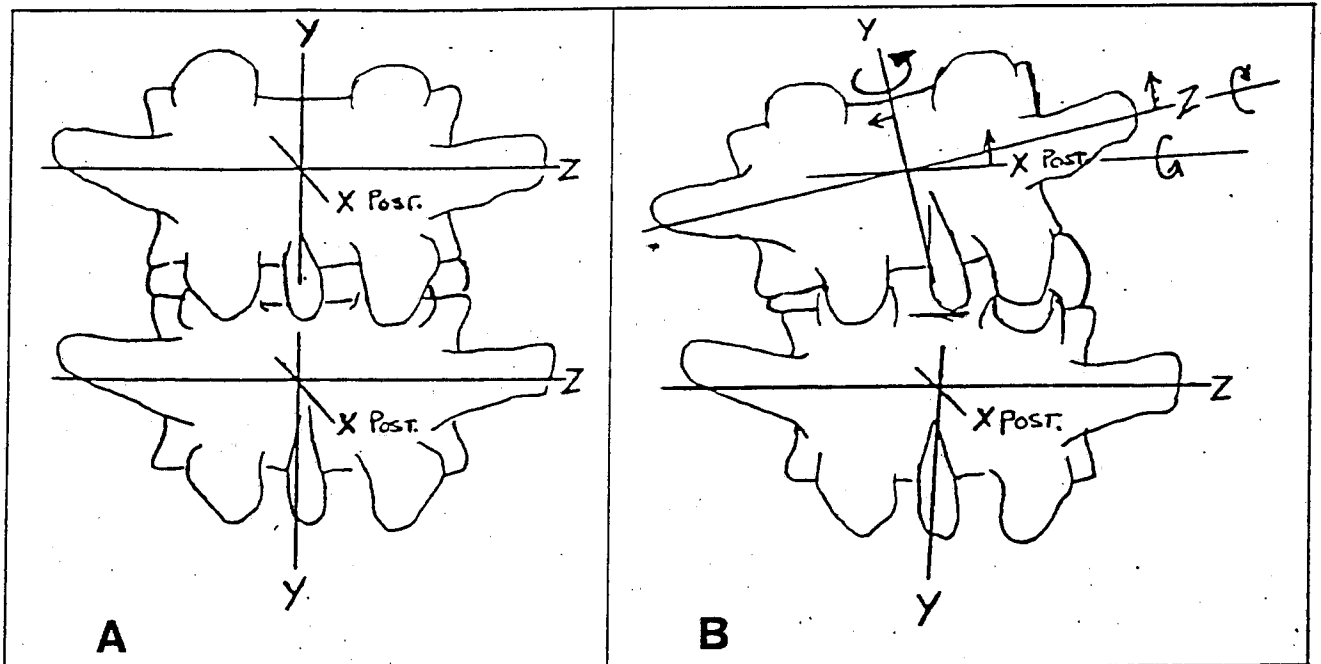
LUMBAR DISC HERNIATION

Figure 5. A. Normal lateral view of L4 and L5. B. Lateral view of a posterior lateral disc herniation with a loss of lordosis.

Source: Barrale, R., Diamond, R., Filson, R., & Wittmer, M. (1989). Manipulative management of lumbar disc bulge. Chiropractic Technique, 1(3), 79-87.

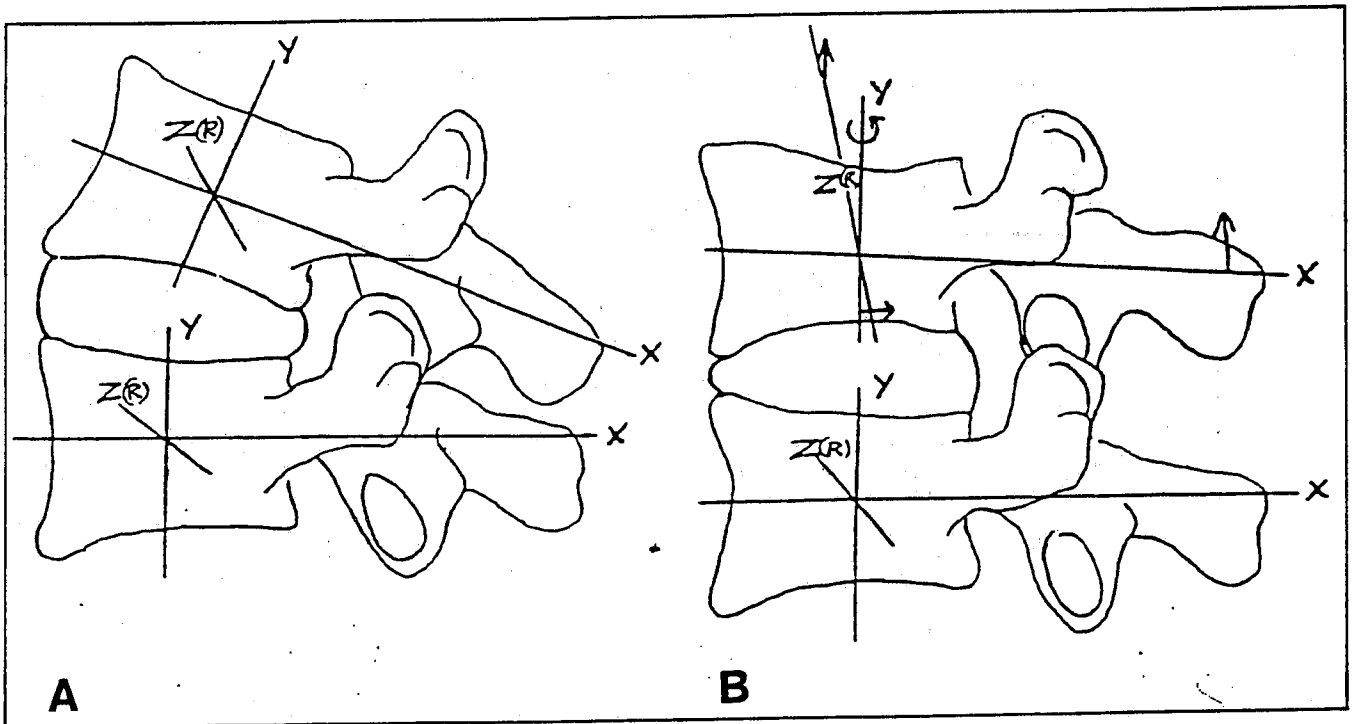
LUMBAR DISC HERNIATION

Figure 6. A. Normal posterior to anterior view of L4 and L5. B. A posterior lateral disc herniation in the posterior to anterior view.

Source: Barrale, R., Diamond, R., Filson, R., & Wittmer, M. (1989). Manipulative management of lumbar disc bulge. Chiropractic Technique, 1(3), 79-87.



FLEXION DISTRACTION

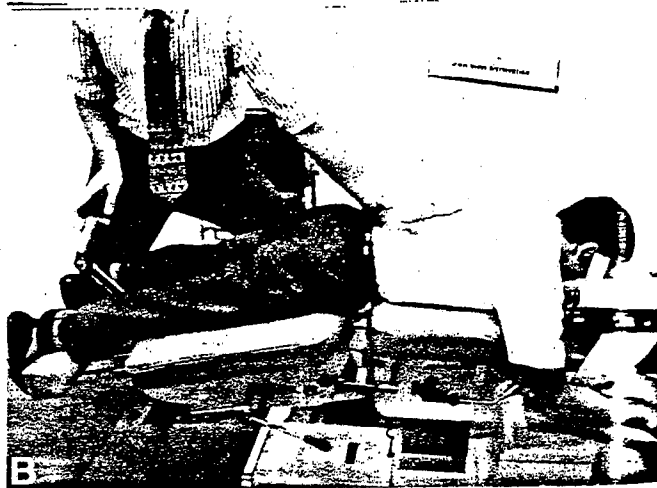


Figure 7. Patient and doctor placement during flexion distraction manipulation.

Source: BenEliyahu, D.J. (1996). Magnetic resonance imaging and clinical follow-up: study of 27 patients receiving chiropractic care for cervical and lumbar disc herniations. Journal of Manipulative and Physiological Therapies, 19(9), 597-605.

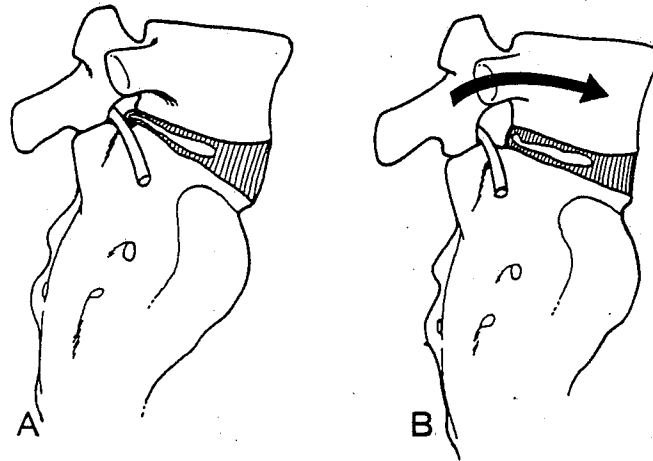
FLEXION DISTRACTION

Figure 8. A. Displaced disc material of an L5 vertebra. B. The +Z force applied during flexion distraction to influence the position of the herniated disc.

Source: Plaugh, G. (1993). Textbook of Clinical Chiropractic. Baltimore: Williams and Wilkins.

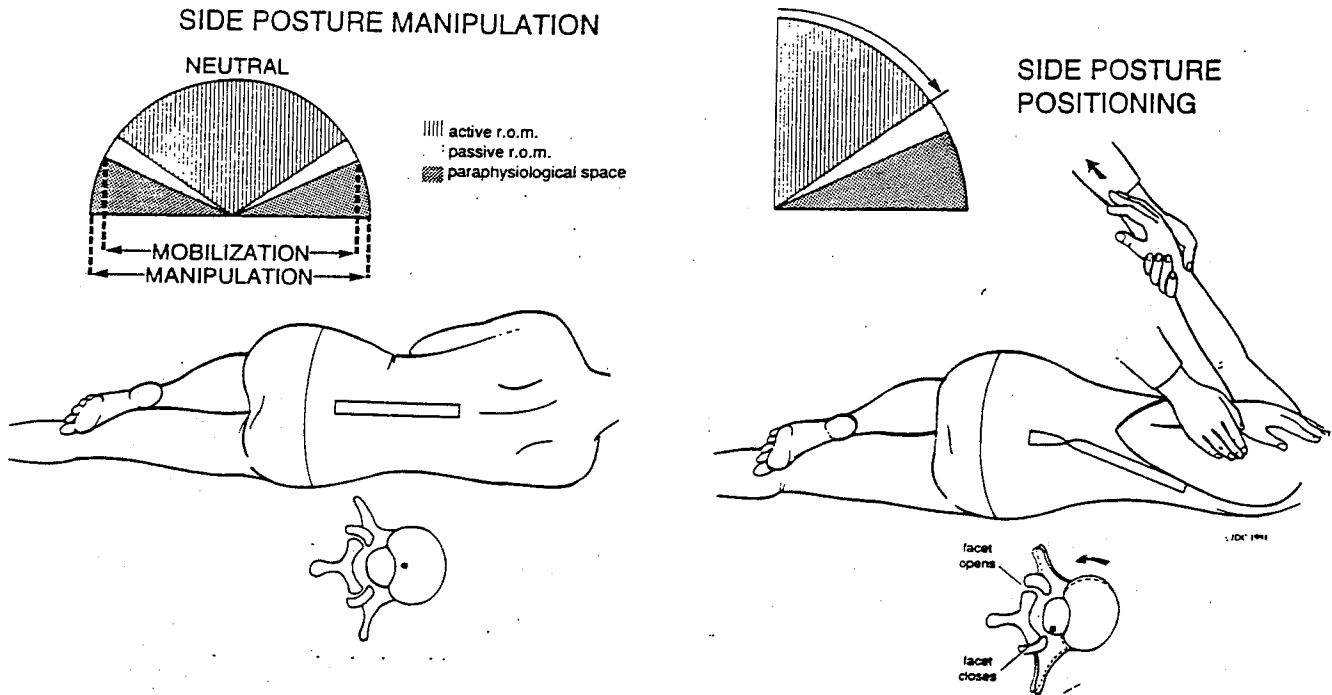
SIDE POSTURE MANIPULATION

Figure 9. Side posture manipulation begins with the patient in the illustrated position. The straight bar represents the spine and the overall ROM is represented in the pie diagram (active ROM, passive ROM, paraphysiological ROM).

Figure 10. Side posture positioning involves counter rotation of the spine on the pelvis, producing lateral flexion and rotation in the lumbar spine. The lumbar spine is brought through its active ROM.

Source: Cassidy, J.D., Thiel, H.W., & Kirkaldy-Willis, W.H. (1993). Side posture manipulation for lumbar intervertebral disk herniation. Journal of Manipulative and Physiological Therapeutics, 16(2), 96-102.

SIDE POSTURE MANIPULATION

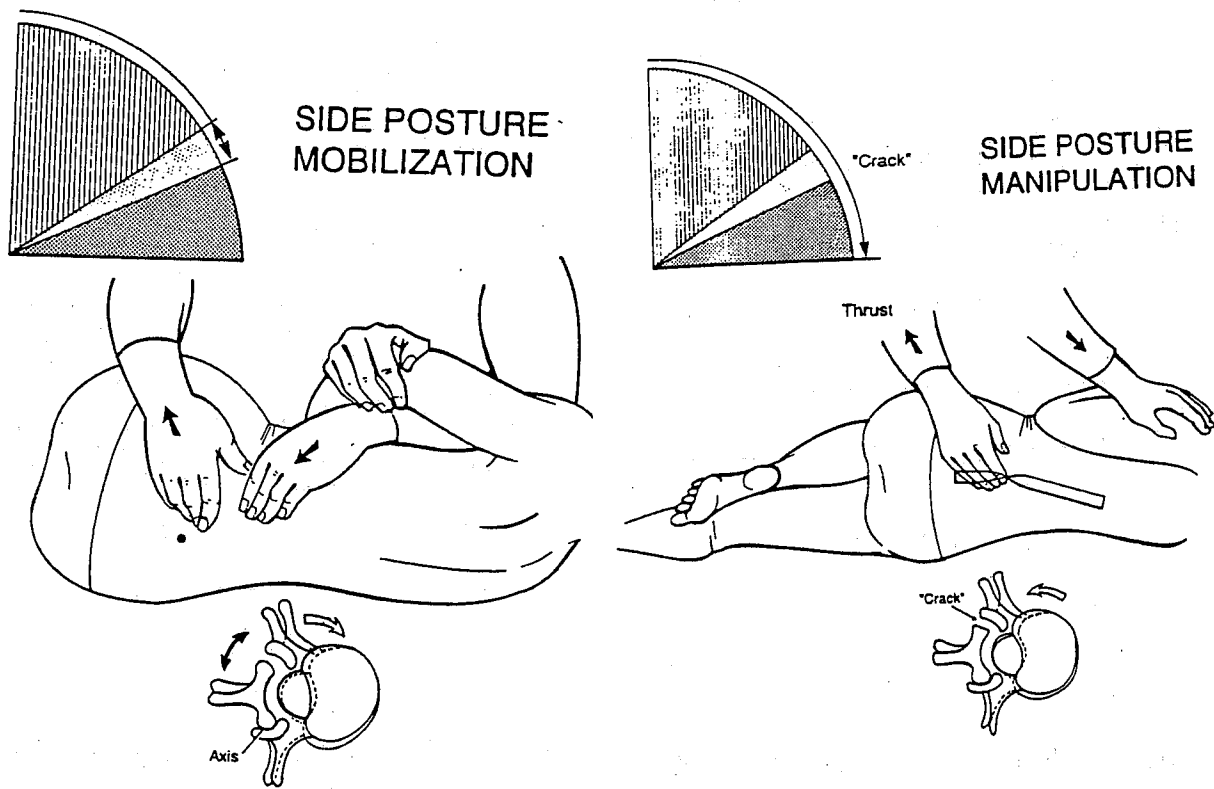


Figure 11. Side posture mobilization of the spine moves the joint through its passive ROM.

Figure 12. Side posture manipulation of the spine causes cavitation of the joint, moving it into the paraphysiological ROM.

Source: Cassidy, J.D., Thiel, H.W., & Kirkaldy-Willis, W.H. (1993). Side posture manipulation for lumbar intervertebral disk herniation. Journal of Manipulative and Physiological Therapeutics, 16(2), 96-102.

SIDE POSTURE MANIPULATION

## SEGMENTAL LOCALIZATION OF MANIPULATION

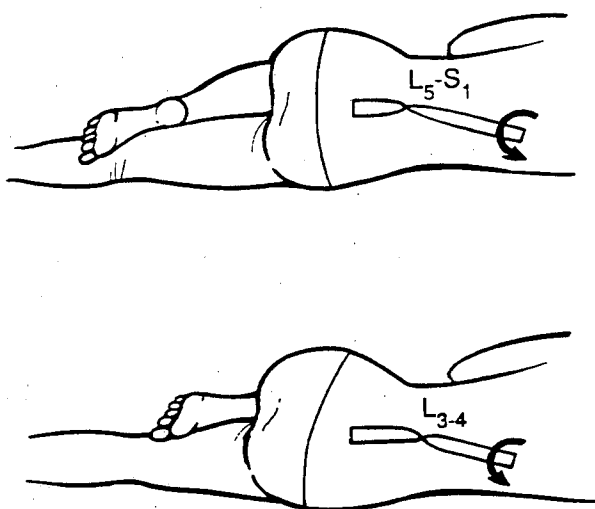


Figure 13. Side posture manipulation can be localized to the lower or upper levels of the lumbar spine by changing the amount of hip flexion. Increased hip flexion manipulates higher levels.

Source: Cassidy, J.D., Thiel, H.W., & Kirkaldy-Willis, W.H. (1993). Side posture manipulation for lumbar intervertebral disk herniation. Journal of Manipulative and Physiological Therapeutics, 16(2), 96-102.

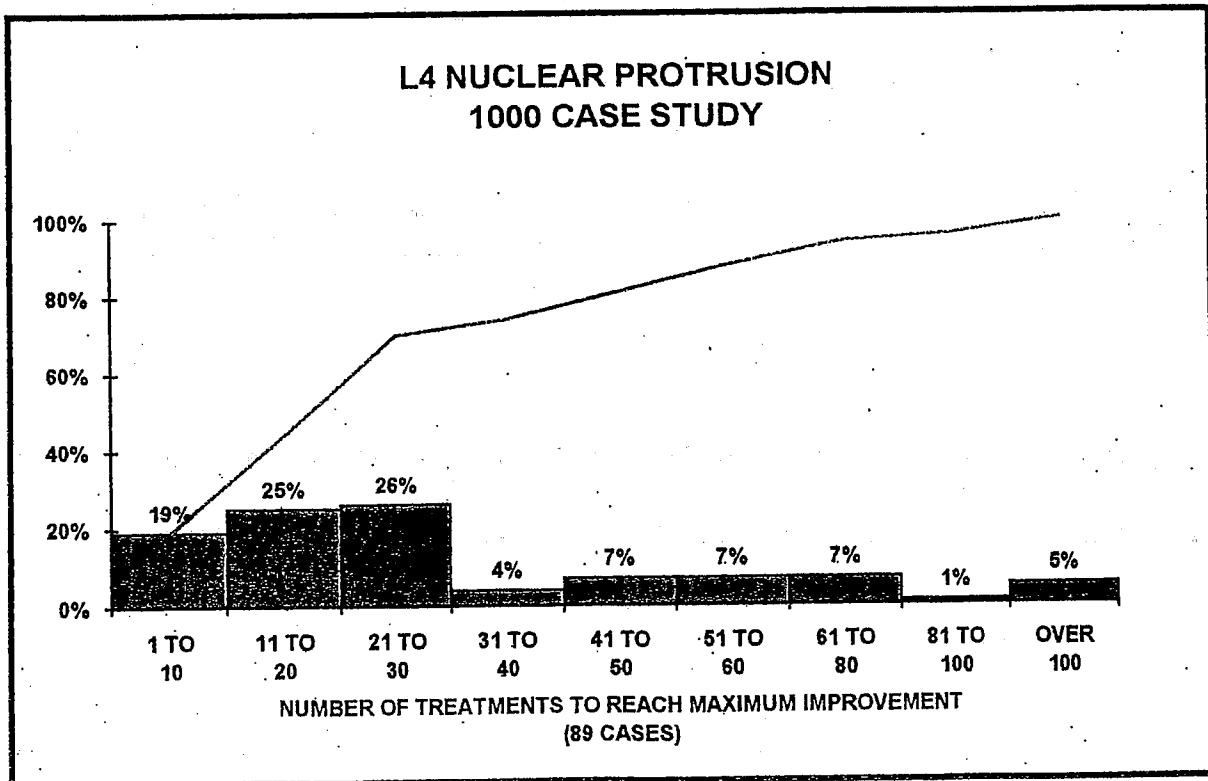
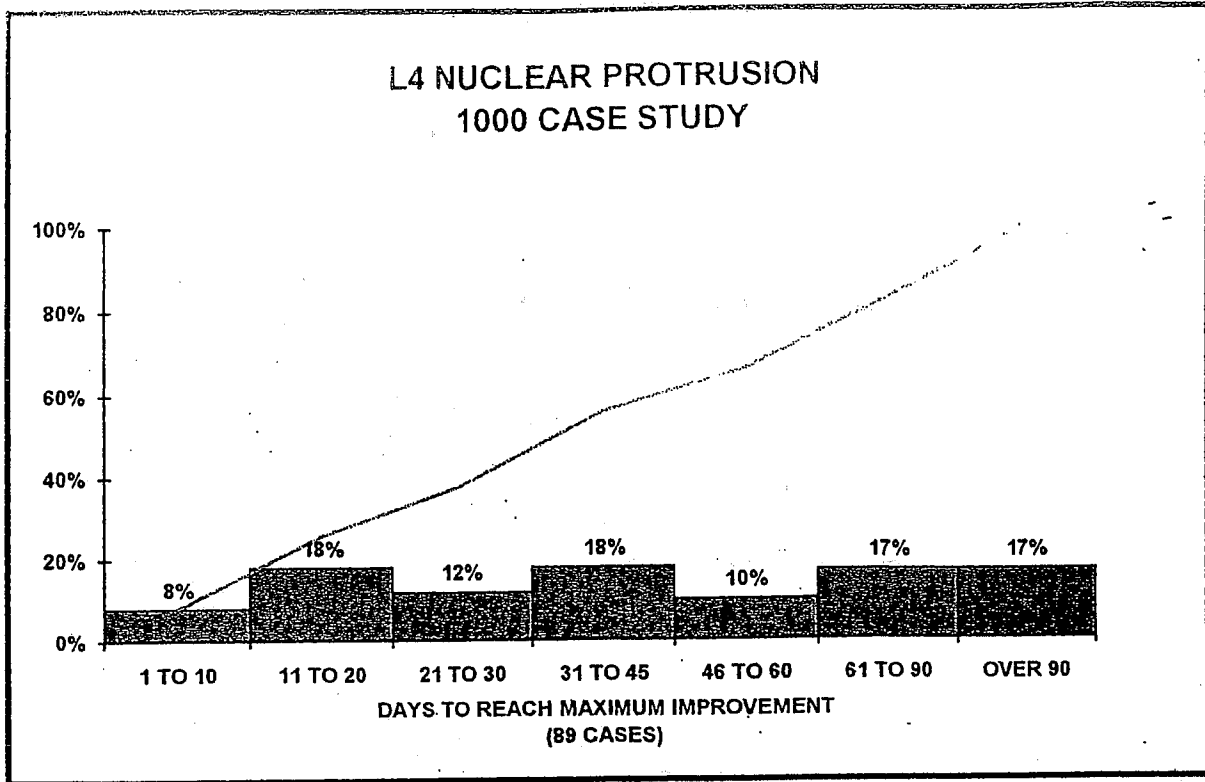


Figure 14

Source: Cox, J.M., Feller, J. (1996). Distraction chiropractic adjusting: clinical application and outcomes of 1,000 cases. *Topics in Clinical Chiropractic*, 3(3), 45-59.

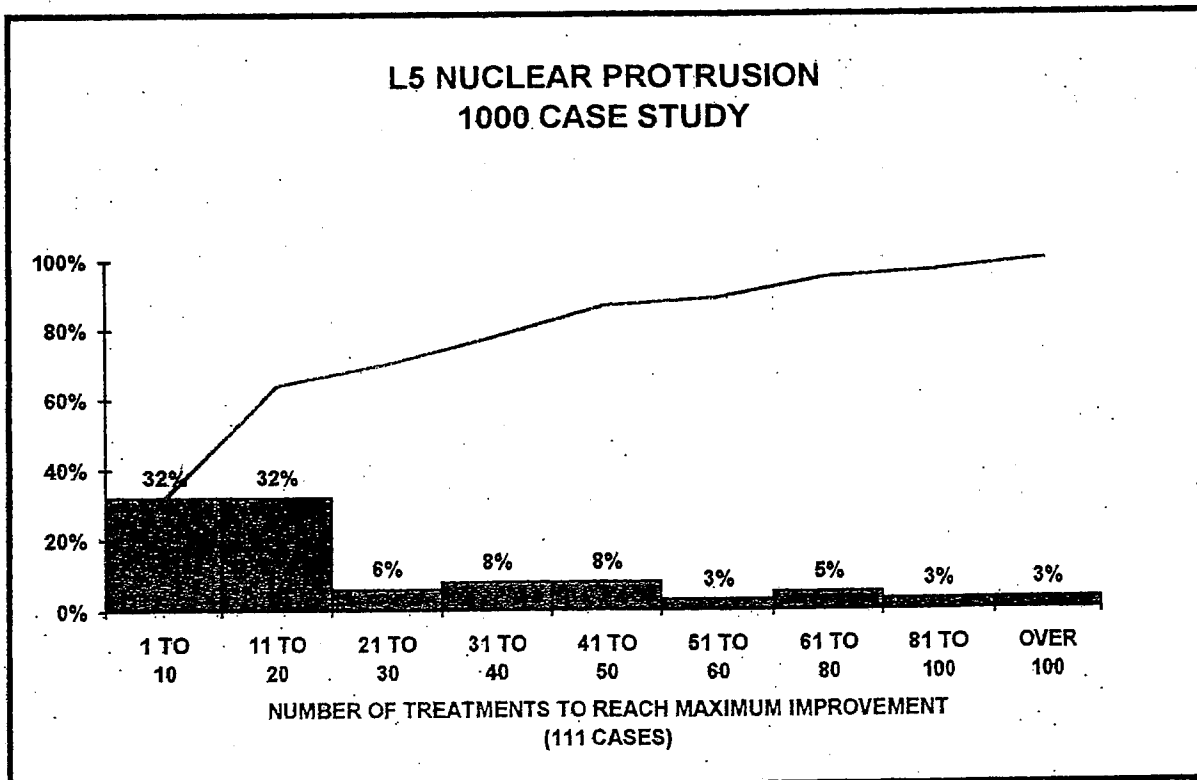
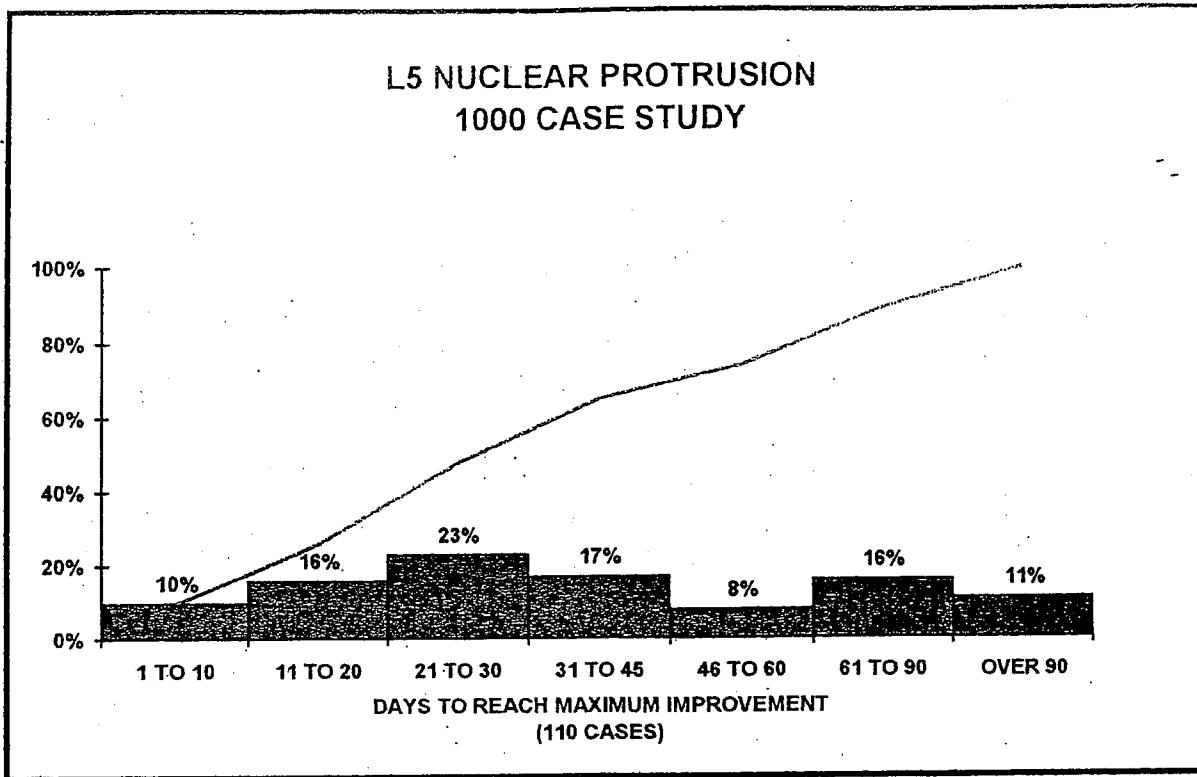


Figure 15

Source: Cox, J.M., Feller, J. (1996). Distraction chiropractic adjusting: clinical application and outcomes of 1,000 cases. *Topics in Clinical Chiropractic*, 3(3), 45-59.

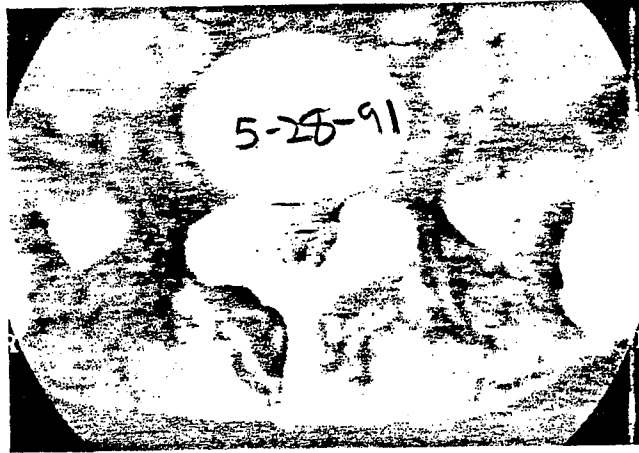
LDH REDUCTION (CT SCAN)

Figure 16. CT scan measurement of the percentage of the spinal canal occupied by the disc herniation in May 1991 showed 40% of the sagittal diameter occupied by the disc.

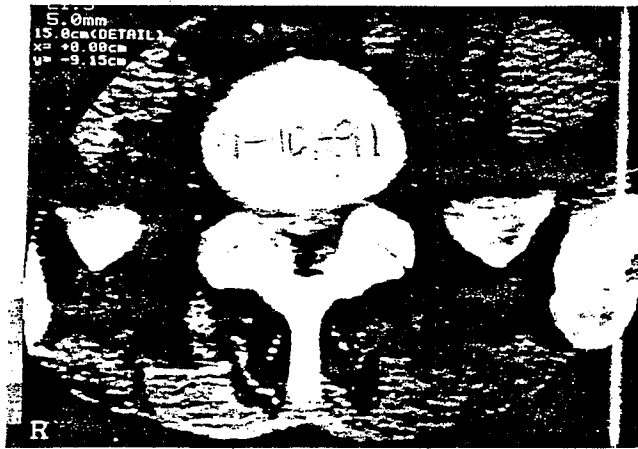


Figure 17. CT scan measurement of the percentage of the spinal canal occupied by the disc herniation in September 1991 showed 33% of the spinal canal occupied by the disc.

Source: Cox, J.M., Hazen, L.J., & Mungovan M. (1993). Distraction manipulation reduction of an L5-S1 disk herniation. The Journal of manipulative and Physiological Therapeutics, 16(5), 342-345.



LDH REDUCTION (MRI SCAN)

Figure 18 Reduced disc herniation more than 70% (arrows). A. Initial sagittal MRI image. B. Follow-up MRI obtained 9 months later.

Source: Boazzo, A., Gallucci, M., Masciocchi, C., Aprile, I., Barile, A., & Passariello, R. (1992). Lumbar disk herniation: MR imaging assessment of natural history in patients treated without surgery. Radiology, 185, 135-141.

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