

# **The Appropriateness of Spinal Manipulation for Low-Back Pain**

## **Project Overview and Literature Review**

Paul G. Shekelle, Alan H. Adams, Mark R. Chassin,  
Eric L. Hurwitz, Reed B. Phillips, Robert H. Brook

**RAND**

The research described in this report was supported jointly by the Consortium for Chiropractic Research and the Foundation for Chiropractic Education and Research, Grant No. 89-038.

ISBN: 0-8330-1150-2

The RAND Publication Series: The Report is the principal publication documenting and transmitting RAND's major research findings and final research results. The RAND Note reports other outputs of sponsored research for general distribution. Publications of RAND do not necessarily reflect the opinions or policies of the sponsors of RAND research.

Published 1991 by RAND  
1700 Main Street, P.O. Box 2138, Santa Monica, CA 90407-2138

R-4025/1-CCR/FCER

# **The Appropriateness of Spinal Manipulation for Low-Back Pain**

## **Project Overview and Literature Review**

Paul G. Shekelle, Alan H. Adams, Mark R. Chassin,  
Eric L. Hurwitz, Reed B. Phillips, Robert H. Brook

Supported by the  
Consortium for Chiropractic Research  
Foundation for Chiropractic Education and Research

**RAND**



## PREFACE

This report presents results from one part of the RAND Appropriateness of Spinal Manipulation for Low-Back-Pain Study. The study is designed to ascertain the clinical criteria for the appropriate use of spinal manipulation for low-back pain from chiropractors and medical specialists and then to investigate the use of chiropractic services (particularly spinal manipulation) in a random sample of practicing chiropractors. The study has four major stages:

- Stage I reviewed the medical literature to summarize knowledge about efficacy, complications, and indications for spinal manipulation for low-back pain.
- Stage II convened a panel of back-pain experts from the disciplines of orthopedics, chiropractic, osteopathy, internal medicine, family medicine, and neurology to discuss and rate for appropriateness a large number of indications for spinal manipulation for low-back pain.
- Stage III will convene a second, all-chiropractic panel of experts, to discuss and rate the same indications for spinal manipulation for low-back pain.
- Stage IV will analyze the use of services in a random sample of practicing chiropractors, with an emphasis on abstraction of medical records for patients treated for low-back pain.

This report presents the results of the first stage. It describes what is known in the medical literature about the utilization, efficacy, complications, and indications for spinal manipulation for low-back pain. It should be of interest to clinicians who perform spinal manipulation, clinicians who deal with patients with back pain, and to health researchers concerned with the appropriate indications for performing medical procedures.

This research is a joint undertaking of RAND; the UCLA Division of General Internal Medicine, Department of Medicine; the Consortium for Chiropractic Research (CCR); the Foundation for Chiropractic Education and Research (FCER); and Value Health Sciences, Inc. Support has been provided by the CCR and the FCER.



## SUMMARY

This report contains a literature review of spinal manipulation for low-back pain. Spinal manipulation is a manual procedure that involves a directed thrust to move a joint past the physiologic range of motion without exceeding the anatomic range of motion. Spinal manipulation has been used for centuries as a treatment for musculoskeletal complaints. In recent times, the use of spinal manipulation has been equated with the practice of chiropractic, and, in part because of this, spinal manipulation has been labeled an "unorthodox" treatment by the medical profession. This review covers the literature from 1952 to the present on the use of spinal manipulation. It gathers data from 76 sources including 22 controlled trials of the use of spinal manipulation for low-back pain.

## UTILIZATION

Based on limited data, it is estimated that about 5% of the U.S. population annually uses chiropractors. The majority of patients seek care for back pain and related complaints and are usually treated with spinal manipulation. The course of treatment generally involves multiple visits and manipulations, between 5 and 18 per episode. This care is delivered by about 45,000 chiropractors at a cost of approximately \$2.4 billion annually. In one study, chiropractors delivered upwards of 90% of the manipulative therapy for which reimbursement was sought. Chiropractic patients are more likely to be white, middle-aged, and employed than the general population.

## COMPLICATIONS

There is no systematic report on the frequency of complications. Collections of anecdotal reports suggest that the serious complications of spinal manipulation include death, paraplegia, and advancement of unrecognized coexisting medical disorders because of misdiagnosis. The rate of these occurrences is probably low, but the lack of data in the literature prevents firm conclusions.

## EFFICACY

The literature on the efficacy of spinal manipulation is of uneven quality. While many studies are randomized controlled trials, there is a great diversity in the initial selection and evaluation of patients for study, assignment of those patients to spinal manipulation or a control treatment, the type of spinal manipulation given, the type of control treatment given, and the method of assessing a response. Given that caveat, support is consistent for the use of spinal manipulation as a treatment for patients with acute low-back pain and an absence of other signs or symptoms of lower limb nerve-root involvement. Support is less clear for other indications, with the evidence for some insufficient (acute and subacute low-back pain with sciatica, acute and subacute low-back pain with minor lower limb neurologic findings, most types of chronic back pain), while the evidence for others is conflicting (acute low-back pain with sciatica and minor lower limb neurological findings, subacute low-back pain without sciatica, and chronic low-back pain without sciatica).

## **TREATMENT DURATION**

No scientific evidence in the literature supports any of the treatment durations for different indications that have been proposed.



## ACKNOWLEDGMENTS

The authors gratefully acknowledge Bernard Rineberg, M.D., for his advice and review of this project and report, and Richard Kravitz, M.D., for his thoughtful and constructive critique of this report.



# CONTENTS

PREFACE .....	iii
SUMMARY .....	v
ACKNOWLEDGMENTS .....	vii
TABLES .....	xi
Section	
1. PROJECT OVERVIEW .....	1
2. LITERATURE REVIEW .....	3
Utilization .....	3
Complications .....	4
Efficacy .....	5
Acute Low-Back Pain .....	6
Subacute Low-Back Pain .....	9
Chronic Low-Back Pain .....	11
Other Concerns .....	13
Appendix: CONTROLLED TRIALS OF SPINAL MANIPULATION .....	17
REFERENCES .....	23



**TABLES**

1. Classification of research articles on manipulation for back pain .....	4
2. Ohio State Chiropractic Association guidelines for frequency and duration of treatment .....	14
3. La Brot's guidelines for frequency and duration of treatment .....	14



## 1. PROJECT OVERVIEW

The appropriateness with which health services are used has been gaining increasing attention over the last decade. As health care costs continue to climb and as evidence mounts that some medical and surgical procedures are overused, there is a growing perception that the United States is not receiving sufficient value for its expenditures on health. The demonstration of large geographic variations in the use rate of medical care, beyond those explained by underlying differences in the populations at risk, has led some to question whether physicians agree on the type and amount of medical care that is appropriate for certain conditions. Considerable research has indicated uncertainty even among nationally recognized experts in the conditions under question. This underlying uncertainty about how to treat certain diseases may be in part responsible for overuse and for the needless expenditure and risk such inappropriate use places upon payors and patients.

Back pain occurs in up to 80% of adults at some point in their lives (Deyo, 1983) and is one of the leading causes of visits to physicians (Deyo, 1983; Deyo, 1987). Except in rare presentations, it is appropriate for most persons with back pain to undergo an initial course of conservative therapy (Deyo, 1983). These conservative measures have included oral medications, injectable drugs, counter-stimulation (such as transcutaneous electrical nerve stimulation), and physical measures (such as bedrest, corsets, exercises, and manipulation). Manipulation is among the most controversial of these measures. Although practiced for centuries, no evidence to date conclusively proves the effectiveness or lack thereof for the use of spinal manipulation to treat back pain. This, combined with the association of spinal manipulation with the practice of chiropractic, has relegated the use of spinal manipulation to the "unorthodox" category of treatments among the medical (allopathic) profession.

Spinal manipulation, however, is the most commonly used conservative treatment for low-back pain for which reimbursement is sought. About two-thirds of all patient visits for back pain are made to chiropractors (Murt, 1986). Most of these patients are treated with spinal manipulation. This care cost approximately \$2.4 billion in 1988 (*FACTS Bulletin*), while the total cost of direct medical care for back pain in the United States is estimated at \$8 billion annually (Bonica, 1982).

For all of these reasons—the prevalence of back pain in America, its cost to society, and the uncertainty about the role spinal manipulation should play in its treatment—RAND; the UCLA Division of General Internal Medicine, Department of Medicine; the Consortium for Chiropractic Research (CCR); the Foundation for Chiropractic Education and Research (FCER); and Value Health Sciences, Inc. (VHS), have undertaken an examination of the appropriate use of spinal manipulation in the treatment of low-back pain. Support has been provided by the National Institutes of Health, the CCR, and the FCER.

This project will result in a comprehensive set of indications for performing spinal manipulation for persons with low-back pain and will have two sets of appropriateness ratings of these indications: one by a multidisciplinary panel of experts, representing the disciplines of orthopedics, osteopathy, chiropractic, internal medicine, neurology, and family practice, and the second by an all-chiropractic panel. From these ratings, we will develop a medical record abstraction form, a utilization form, and a patient survey. These research instruments will then be used on a random sample of low-back pain patients of chiropractors from a specified geographic area to answer the following research questions:

- What is the use of chiropractic services in the specified geographic area?
- With regard to the chiropractic spinal manipulative therapy of low-back pain, what is the level of appropriate care being delivered?
- Does the level of appropriate care vary significantly with the provider?
- Are there variables predictive of the delivery of appropriate care?
- What are the demographic and general health characteristics of chiropractic patients, and do these differ from patients in the outpatient general medical setting?

RAND publications from this project will consist of the following:

1. This volume, which contains the project overview and literature
2. The ratings of appropriateness by the multidisciplinary panel
3. The ratings of appropriateness by the all-chiropractic panel
4. The analysis of the two sets of ratings
5. The research instruments
6. The results of the one-site field study of the use of chiropractic services, the use of spinal manipulation, and the chiropractic patients' characteristics.



## 2. LITERATURE REVIEW

Spinal manipulation as a treatment for musculoskeletal complaints has been practiced for centuries, having been described by Hippocrates, Galen, and other Western physicians, as well as in the writings of comparable historical figures in Eastern medical history. Many prominent physicians of the 19th century practiced spinal manipulation, and late in that century the two principal philosophies concerning spinal manipulation were developed. Andrew Taylor Still proposed the concept of osteopathy in 1874, and D.D. Palmer formulated the theory of spinal subluxation in 1895. Since then, spinal manipulation has fallen out of favor with medical physicians and has become virtually the exclusive domain of chiropractors. A recent analysis of a community-based sample of patients showed that chiropractors delivered 94% of all the manipulative care for which reimbursement was sought, with osteopaths delivering 4%, and general practitioners and orthopedic surgeons accounting for the remainder. Recently, however, there seems to be a renewed interest in manipulation on the part of the medical profession (Meade, 1990).

Manipulation encompasses many different techniques. The two most commonly used methods are nonspecific long-lever manipulations and specific short-lever, high-velocity spinal adjustments. It is this second method which is most closely identified with chiropractic practice, although many chiropractors use the long-lever manipulations as well.

This literature review will examine the use of manipulation, of all types, in the treatment of low-back pain. The review initially searched the Index Medicus and computerized database of MEDLINE from 1952 to the present for relevant articles using the Medical Subject Heading terms *chiropractic*, *manipulation*, and *backache*. It then drew on the bibliography of these articles, as well as a bibliography developed by the CCR. An orthopedist and two chiropractors evaluated the bibliography for completeness and suggested additional references, including textbooks. No unpublished material was included.

Articles were selected for inclusion if they contained data on the complications, efficacy, or use of manipulation for the treatment of low-back pain. Priority was given to research that used a randomized, controlled trial design. Second priority was given to case-series and reviews published in peer-reviewed journals, as well as textbooks. Case reports were excluded, except to document complications.

This review is the result of an analysis of 67 articles and 9 books or textbooks published between 1952 and 1991. The table below presents the number of studies or articles reviewed, classified by type of research design or source.

This review was prepared to assist back-pain experts in the assessment of the appropriate clinical circumstances for performing spinal manipulation. As such, it summarizes efficacy data in clinical categories that were used by these experts during the assessment process.

### UTILIZATION

Utilization studies of the chiropractic manipulative treatment of low-back pain are few. Most are either regional, lack adequate sampling schemes, or have possibly outdated

**Table 1**  
**CLASSIFICATION OF RESEARCH**  
**ARTICLES ON MANIPULATION**  
**FOR BACK PAIN**

Category	Number	Percent
Research studies	34	45
Controlled trials	(22)	—
Case-series	(12)	—
Case reports	4	5
Reviews	22	29
Miscellaneous	7	9
Books/textbooks	9	12
Total	76	100

databases that do not allow generalization with confidence to the 1990s. Still, some statements can be made.

The rate of use of chiropractic services is approximately 50 visits per 100 person-years, used by about 5% of the population (Von Kuster, 1980; Mugge, 1986; Shekelle, 1991). This care is delivered by about 45,000 chiropractors at a cost of approximately \$2.4 billion in 1988 (*FACTS Bulletin*, 1989). Between 32 and 45% of these visits are for low-back pain (Phillips, 1982; Nyiendo, 1987; Pima Health Systems, 1975; Shekelle, 1991). The patients average between 5 and 18 visits per episode (Nyiendo, 1987; Phillips, 1982; Shekelle, 1991; Von Kuster, 1980). This type of care is most frequently used by persons who are white, middle-aged, employed, and high-school educated (New Haven Health Care, Inc., 1976; Mugge, 1986; Nyiendo, 1987; Shekelle, 1991). Seven-fold differences in the use rate of chiropractic services have been seen, but the cause or causes of these variations in use remain unknown (Shekelle, 1991). In one study, chiropractors delivered over 90% of the manipulations for which reimbursement was sought (Shekelle, 1991).

## COMPLICATIONS

There has been no systematic study of the frequency of complications from spinal manipulative therapy. A literature review by Ladermann (1981) showed 135 case reports of serious complications, including 18 deaths, from manipulation. These case reports are primarily from the period 1950 to 1980. The number of manipulations received during this 30-year period is unknown, but must number in the tens of millions.

The majority of complications of manipulation can be attributed to the following:

- Misdiagnosis
- Presence of coagulation dyscrasias
- Cervical manipulation
- Presence of herniated nucleus pulposus
- Improper technique.

Misdiagnosis of the patient's condition accounted for 26 of the 135 cases in the report of Ladermann. Most of these involved the unrecognized presence of tumors or metastases. The main complication was delay in diagnosis and treatment. The most serious complication of coagulation dyscrasias was paraplegia from meningeal hematoma. Cervical manipulation had a greater number of complications, of a more serious nature, than did lumbar manipula-

tion. This literature review will not deal with cervical manipulation. The development of the cauda equina syndrome was reported in 20 patients with the presenting symptom of sciatica treated with lumbar manipulation. Many of these patients were manipulated under narcosis or ether anesthesia, which is not acceptable chiropractic technique today. Improper technique, while important, is not the subject of this review, nor the focus of the panel discussion.

These data suggest that the risk of spinal manipulation is small and that it may vary within subgroups of patients based on their clinical presentation. No firm conclusions may be drawn, however, as there is little available data in the literature.

## EFFICACY

The efficacy of spinal manipulation for low-back pain must be assessed by the degree of benefit compared to risk it confers on patients upon whom it is performed. As no survival benefit has ever been shown or claimed, this assessment is necessarily based on subjective or objective evaluations of relief of pain, time to relief of pain, improvement in functional status, days lost from work, reduced anxiety, and the like. Additionally, certain physiologic variables, such as flexibility and number of degrees of straight leg raising, have been measured, but in general there is a poor correlation between these measures and functional status.

Ideally, the efficacy of spinal manipulation for the treatment of low-back pain would be assessed by performing a series of randomized, controlled clinical trials upon patients with a variety of different clinical presentations. The patients would need to be selected with an appreciation of the clinical variables predictive of a beneficial result from manipulation. The nonmanipulated group would need to receive some sham treatment to control for the powerful placebo affect of "the laying on of hands." The manipulation itself would be done by an expert clinician and would be defined in terms such that others could reproduce the technique. The assessment of outcome would be performed by observers blinded to the treatment type. The sample size would be large enough to have sufficient power to detect a clinically significant effect should it exist. If a benefit for manipulation was shown, then manipulation could be compared to other therapies for low-back pain, including bedrest, "back school," corset, and TENS, in another series of randomized trials. Such a research agenda would take many trials, involving many patients, over a considerable period of time. For these reasons and others, the definitive trials of manipulative therapy have yet to be done, as many have noted (Brunarski, 1984; Curtis, 1988; Greenland, 1980; Evans, 1985; Hoehler, 1987; Deyo, 1983). Because of the cost and technical difficulties, such a series of trials is unlikely to be completed in the near future. Therefore, as stated by Curtis, the efficacy of spinal manipulation is neither scientifically proven nor disproven at this time.

This review will deal with what is known about the efficacy of spinal manipulation for patients with the following specific clinical problems:

- Acute low-back pain
  - without neurological findings
  - with minor neurological findings
  - with major neurological findings
  - with sciatic nerve root irritation
- Subacute low-back pain
  - without neurological findings
  - with minor neurological findings
  - with major neurological findings

- with sciatic nerve root irritation
- Chronic low-back pain
  - without neurological findings
  - with minor neurological findings
  - with major neurological findings
  - with sciatic nerve root irritation
  - with prior laminectomy.

In addition, this review will deal with some other issues of importance concerning spinal manipulation, including contraindications and treatment intensity and duration.

Before discussing specific clinical syndromes, it is important to mention the limitations, of a general nature, with the controlled trials of manipulation. The initial selection and evaluation of patients for study has varied greatly. Some studies have included all patients presenting to a certain clinic, regardless of duration of pain, mechanism of onset, age, physical exam, etc. Others have carefully restricted patients to those with pain of uniform onset, those who have specific findings on physical examination, or other factors. The technique of manipulation is often unclear in many studies and has been performed by a variety of health personnel, including physicians, chiropractors, physiotherapists, and osteopaths. The control groups have varied widely, some receiving virtually no therapy, most receiving a variety of nonspecific measures, such as short-wave diathermy, and a few receiving sophisticated sham manipulations. How these control groups dealt with the placebo effect differed. Outcome measures were not always assessed by an observer blinded to treatment type, introducing bias. In addition, outcome measures have varied between objective measurements (which are of uncertain clinical significance) to subjective measures ranging from simply asking the patient if he feels better to reliable and valid questionnaires dealing with back pain. Lastly, other problems were of sample size, Type II error, and appropriate statistical analysis. Many studies have so few subjects that no conclusion can be drawn. Outcomes measured on ordinal scales have been analyzed with a chi-square test for distribution rather than a test for trend, detracting from statistical power. The Appendix at the end of this literature review summarizes the salient features of the controlled trials of manipulation for back pain.

For the purposes of this review, acute low-back pain is defined as pain of less than 3 weeks duration; subacute low-back pain is that of 3 to 13 weeks duration; and chronic low-back pain is pain of greater than 13 weeks. Sciatic nerve root irritation is defined as typical radicular pain, meaning shooting pain in the posterior thigh or calf, and a straight leg raising sign in the leg with the pain. Minor neurological findings are defined as at least one of the following: an asymmetrically decreased ankle reflex, a lower limb dermatomal sensory deficit, or a nonprogressive lower limb muscle weakness. Major neurological findings are either a progressive, unilateral lower limb muscle weakness or symptoms or signs of the cauda equina syndrome.

## **ACUTE LOW-BACK PAIN**

**Without neurological findings or sciatic nerve root irritation.** Two controlled trials included only patients with acute low-back pain without neurological findings or sciatic nerve root irritation (Coyer, 1955; Rasmussen, 1979). Both showed a short-term benefit for manipulation compared to controls of bedrest or diathermy, in terms of time to pain relief. In the study by Coyer, there was a steadily decreasing advantage for the manipulated group at 3 and 6 weeks. Rasmussen's study is limited by its 2-week follow-up and its nonblinded as-

assessment of results. An additional controlled trial by Doran (1975), which excluded patients with neurological findings or sciatic nerve root irritation but included patients with acute, subacute, and chronic pain, did not show any benefit for manipulation when compared to three control groups of physiotherapy, a corset, or bedrest. Hoehler (1987) reanalyzed these data using a test for trend (rather than the statistically weaker chi-square test for distribution) and showed a benefit of manipulation for improvement of pain at 3 weeks.

The study by Bergquist (1977) included patients with both acute and subacute low-back pain; however, 83% of patients had pain of less than 3 weeks duration. Patients with neurological findings were excluded. Sciatica was not excluded, though only 27% had sciatic nerve root irritation. Bergquist found no difference between "combined physiotherapy," which included manipulation to hypomobile joints and "back school," but both were significantly better than "placebo" in shortening the time to total recovery. No difference was found between groups in the rate of development of chronic pain, or the rate of recurrences of back pain within 1 year.

In other studies, Maitland (1957) reported his noncontrolled case series of 220 patients. Patients with acute low-back pain, without neurological findings, constituted 51% of the total. Twenty patients were treated with bedrest, yielding a 50% response rate requiring an average of 23 days treatment. His next 75 patients, plus six "failures" from the bedrest group, were treated with manipulation, yielding a 96% response rate in an average of 4.5 treatments. Potter (1977) reported a response rate of 93% for patients with acute low-back pain and no leg pain or neurological findings (N=115; average number of treatments = 3.3) in his large case series.

In summary, the literature supports the use of spinal manipulation or bedrest for patients with acute low-back pain without evidence of neurological involvement or sciatic nerve irritation, with spinal manipulation possibly conferring a short-term but significant benefit in pain relief.

**Without minor neurological findings but with sciatic nerve root irritation.**

One study restricted its patients to those with acute back pain without minor neurological findings, but did include those with sciatic leg pain, and presumably sciatic nerve root irritation as well (Farrell, 1982). In this study, there was a short-term benefit for the manipulated group compared to a control group that received diathermy, exercises, and instruction; the difference was gone by 3 weeks.

Mathews (1987) included both patients with acute and subacute pain; otherwise, the sample patients were without minor neurological findings, but some did have sciatic nerve root irritation. There was an impressive short-term benefit for those patients with straight leg raising signs at 2 weeks. Follow-up at 1 year showed no difference between the manipulated group and the comparison group, which received infrared heat.

In the trial by Bergquist (1977), 83% of patients had acute pain and 27% of patients had sciatic nerve root irritation. "Back school" or "combined physiotherapy" (which included manipulation) were significantly better treatments than was diathermy (15.8, 14.8, and 28.7 days to recovery, respectively). This study is discussed in more detail in the section above entitled "Without Neurological Findings or Sciatic Nerve Root Irritation."

In summary, the literature is insufficient to support or refute the use of spinal manipulation for patients with acute low-back pain and sciatic nerve root irritation. The limited data available suggest that for this class of patients, like those with acute low-back pain but without sciatic nerve root irritation, spinal manipulation may offer a short term benefit in terms of pain relief.

**With minor neurological findings and without sciatic nerve root irritation.** No study confined its patient population to only those with acute low-back pain with minor neurological findings without sciatic nerve root irritation. Meade's two studies (1986, 1990), which had patients with acute, subacute, and chronic back pain, included those with minor neurologic findings and excluded those with sciatic nerve root irritation (but not leg pain alone). Both studies showed a statistically significant benefit for "chiropractic care" (which almost always included manipulation) vs. "medical care" (which may have included nonchiropractic manipulation as well) in terms of the Oswestry Disability Questionnaire, a reliable and valid instrument to assess functional status. The later study showed the benefit to be both durable (up to 2 years follow up) and equivalent for patients with acute (pain less than 1 month), subacute, and chronic (pain greater than 1 month) back pain.

In summary, the literature is insufficient to support or refute the use of spinal manipulation for patients with acute low-back pain and minor neurological findings without sciatic nerve root irritation.

**With minor neurological findings and sciatic nerve root irritation.** There is one controlled trial of manipulation for patients with acute low-back pain and minor neurological findings who also all presumably had sciatic nerve root irritation (Nwuga, 1981). These patients also had disc protrusion confirmed by myelography. There was a significantly shorter time to pain relief in the manipulated group vs. a control group, which received diathermy. There was improvement in some, but not all, measured physiologic variables as well. Another study (Hadler, 1987) included patients with generally acute pain (but by our definition included some patients with subacute pain) and patients with signs of sciatica and presumably sciatic nerve root irritation. Overall, no benefit was shown for manipulation vs. mobilization; however, stratified analysis showed a benefit for manipulation in patients with symptoms of between 2 and 4 weeks. In other studies, Maitland (1957) reported a response rate of only 16% to 19% in patients with acute low-back pain and pain radiating down the leg. In contrast, Potter (1977) reported improvement in 48% of his patients with acute low-back pain and neurological findings.

In summary, there is conflicting evidence in the literature on the use of spinal manipulation for patients with low-back pain with minor neurological findings and sciatic nerve root irritation.

**With major neurological findings.** There has been no study, controlled or uncontrolled, describing the manipulative treatment of patients with acute low-back pain and major neurological findings.

**Additional issues.** Vertebral joint fixation, sacroiliac joint fixation, and hypertonic contraction of the paraspinal muscles correspond to the syndromes described by Kirkaldy-Willis and Cassidy (1988) as "Definite and Certain Indications for Manipulation." No controlled trials support this statement. Kirkaldy-Willis and Cassidy report their case series of patients with mainly chronic pain; 80% to 90% of the patients with vertebral or sacroiliac joint fixation responded favorably. Numerous anecdotal reports by Maigne and others document the nearly instantaneous relief of pain due to the third indication (hypertonic contraction of the paraspinal muscles). Chiropractic teaching states that the presence of hypertonic contraction of the paraspinal muscles implies joint fixation.

Spinal manipulation has not been shown to reduce a herniated nucleus pulposus physically. In fact, two studies (Wilson, 1952; Chrisman, 1964) showed that there was no difference myelographically in disc protrusion before and after manipulation. Many patients reported an improvement in symptoms despite the apparent absence of a change in their disc protrusion. In the Chrisman study, the majority of patients who had chronic pain had an

“excellent” or “good” improvement in pain relief (35/39); however 10 of these ultimately had recurrences requiring operations.

The Quebec Task Force, which dealt with the usefulness of a variety of conservative modalities as treatments for low-back pain, classified “mobilisation/manipulation” as “contraindicated on the basis of scientific evidence” for lumbar spinal disorders with radicular compression presumed or confirmed. They cite no references to support this statement, however. Interestingly, the Task Force did not feel manipulation was contraindicated in the presence of confirmed spinal stenosis.

Central spinal stenosis has not been subjected to a controlled trial of manipulative therapy. Kirkaldy-Willis and Cassidy (1988) feel it responds significantly worse to manipulation than other indications; they report 18% of 11 patients were “symptom free” and an additional 18% had only “mild intermittent pain” after manipulation. These 11 patients were “a small, select group of patients with central spinal stenosis who were unfit for surgery.” Cox (1990) states that central spinal stenosis or medial disc protrusion responds poorly to manipulation; he also states that the presence of certain major neurologic findings, such as difficulty walking and rectal difficulties, in the presence of central spinal stenosis or a medial disc protrusion, is an indication for immediate surgical referral.

## SUBACUTE LOW-BACK PAIN

Concerning the appropriateness of treating patients with subacute low-back pain with spinal manipulation, the presence or absence of prior manipulative treatment for the current episode of pain and the response to that treatment is felt by many manipulating physicians to be clinically important. Because of this perception, the appropriateness ratings for subacute low-back pain are divided into two clinical chapters based on prior treatment for the current episode of pain. Because of a lack of scientific studies examining efficacy in this way, this section of the literature review will deal with subacute back pain with or without the presence of neurological findings and sciatic nerve root irritation.

**Without neurological findings or sciatic nerve root irritation.** No controlled study dealt with patients who have only subacute low-back pain without neurological findings or sciatic nerve root irritation. However, four controlled studies dealt with patients without neurological findings who had either subacute or acute and chronic pain. These results may be useful in assessing the appropriateness of spinal manipulation for subacute low-back pain. The study by Doran (1975) included patients with low-back pain of any duration. Doran’s analysis using a chi-square test of distribution showed no benefit for manipulation when compared to any of three control groups. A later reanalysis of these data by Hoehler (1987) using a statistically more powerful test for trend showed a significant benefit for manipulation at 3 weeks (45% vs. 35% improved). Evans (1978) included patients with both subacute and chronic pain who had no signs of femoral or sciatic root compression. Minor neurologic findings were presumably excluded, as well as signs of nerve root compression. There was a significant benefit for manipulation on overall pain scores at 3 weeks when compared to treatment with codeine alone, but the crossover nature of this study and a randomization failure make the validity questionable. Gibson (1985) included patients with both subacute and chronic pain without neurological signs and randomized them to receive diathermy or osteopathic treatment including manipulation. No difference was seen between groups. Lastly, Waagen (1986) reported on 19 patients with subacute or chronic back pain, without neurological findings or sciatic nerve root irritation, who were randomly assigned to manipulation vs. a sham. There was a statistically significant benefit for manipulation on

changes in levels of pain as assessed on the Visual Analogue Scale (manipulation = 1.7 cm difference, controls = 0.6 cm difference) at 2 weeks. This study suffered from 10 dropouts (34%) from those initially selected.

In summary, the literature contains conflicting evidence regarding the use of spinal manipulation for patients with subacute low-back pain without neurological findings or sciatic nerve root irritation. The majority of studies suggest that spinal manipulation may have a short-term benefit in terms of pain relief for this class of patients.

**Without minor neurological findings but with sciatic nerve root irritation.** No controlled study limited its patient population to patients with subacute low-back pain without minor neurological findings but with sciatic nerve root irritation. However, two studies may have included this kind of patient, but did not stratify the analysis to answer this question. Mathews (1987) randomized patients with both acute and subacute low-back pain, without minor neurological findings, to manipulation or infrared heat. The analysis was stratified on the presence or absence of straight leg raising signs and/or femoral nerve stretch test. Patients with these signs showed the greatest improvement for manipulation, with a 30% advantage (to complete recovery) for manipulation at 6 days (based on both clinical assessment and patient self-report on the Visual Analogue Scale). Patients without these signs improved considerably in 2 weeks in both the manipulated group and the nonmanipulated group, with a nonsignificant trend favoring manipulation. The advantage of manipulation was gone by 1 year. The study by Zylbergold (1981) excluded patients with minor neurologic findings; the duration of pain and the presence of sciatic nerve root irritation is unknown. There was no benefit for manipulation when compared to heat and physical therapy in functional status among the 28 patients in the study.

In summary, the literature is insufficient to support or refute the use of spinal manipulation for patients with subacute low-back pain without minor neurological findings but with sciatic nerve root irritation.

**With minor neurological findings but without sciatic nerve root irritation.** No study examined the benefit of spinal manipulation for patients with subacute low-back pain with minor neurologic findings but without sciatic nerve root irritation. The two studies by Meade most nearly address this question. The studies included patients with both acute, subacute, and chronic low-back pain. Patients with minor neurologic findings were not excluded; those with evidence of nerve root compression were. There was a significant improvement in Oswestry Disability Questionnaire score in both studies for those patients randomized to "chiropractic care" vs. "medical care." The later study showed the benefit to be sustained, up to 2 years at least. Analysis of the later study, stratified on duration of pain greater or less than 1 month, showed no difference in the benefit for chiropractic care for those with acute pain vs. those with subacute or chronic pain.

In summary, the literature is insufficient to either support or refute the use of spinal manipulation for patients with subacute low-back pain and minor neurological findings but without sciatic nerve root irritation.

**With minor neurological findings and sciatic nerve root irritation.** The study by Coxhead (1981) involved mainly patients with subacute low-back pain who all had sciatica and presumably included those with minor neurologic findings as well as those with sciatic nerve root irritation. The results showed a statistically nonsignificant trend toward a benefit for manipulation as compared to three control groups treated with a corset, "back school" or traction at 4 weeks; by 4 months the trend was gone. A later reanalysis of these data by Hoehler (1987), using a more powerful statistical test for trend, showed a benefit for manipulation at 4 weeks (82% vs. 73% improved). Two other controlled trials had patients



with minor neurological findings and sciatic nerve root irritation and included subacute low-back pain among others (Hoehler, 1981; Hadler, 1987). The study by Hadler, which was stratified on duration of pain less than 2 weeks or between 2 weeks and 4 weeks duration, showed a benefit for manipulation only in those patients with pain of between 2 and 4 weeks duration (50% greater reduction in pain score at 2 weeks of treatment, compared to controls receiving mobilization). Hoehler's study, which may have included patients with minor neurologic findings and/or sciatic nerve root irritation but was not stratified in that way, showed an immediate benefit for manipulation, which was gone at 3 week follow-up.

In summary, the literature is limited but probably supports the use of spinal manipulation for patients with subacute low-back pain with minor neurological findings and sciatic nerve root irritation, its use conferring a slight short-term benefit in pain relief.

**With major neurological findings.** No study, controlled or uncontrolled, has described the manipulative treatment of patients with subacute low-back pain and major neurological findings.

**Additional issues.** Concerning prior treatment, it is many chiropractors' clinical belief that patients with evidence of joint fixation and a recent episode of back pain are at higher risk to relapse than those without evidence of joint fixation. Because of this, they believe that these patients should undergo manipulation to relieve the undesirable joint restriction, with the belief that this will bring a more durable and lasting improvement in symptoms. This series of beliefs has not been subjected to rigorous study.

With regard to the frequency of treatment for the patient undergoing manipulation, please refer to the section on "Treatment Duration" for a discussion of the literature.

Spinal manipulation has not been shown to reduce a herniated nucleus pulposus physically. Please refer to the discussion under Additional Issues in the section on acute low-back pain for a review of the literature.

The Quebec Task Force concluded that spinal manipulation is contraindicated in the presence of radicular compression. Please see Additional Issues in the section on acute low-back pain for more discussion of this.

Central spinal stenosis has not been subjected to a controlled trial of manipulative therapy. The discussion under Additional Issues in the section on acute low-back pain analyzes this topic in more detail.

## CHRONIC LOW-BACK PAIN

Analogous to patients with subacute low-back pain, many manipulating physicians feel that the type of and response to prior treatment is important in determining the likelihood of a beneficial effect of spinal manipulation for patients with chronic low-back pain. Reflecting this opinion, the appropriateness ratings for chronic low-back pain are divided into three clinical chapters based on prior treatment, although no scientific studies have examined the subject this way. Therefore, this section will deal with chronic back pain with or without the presence of neurological findings and sciatic nerve root irritation. Two case series dealing with response to prior laminectomy will be reviewed.

**Without neurological findings or sciatic nerve root irritation.** No controlled trials dealt only with patients with chronic low-back pain without neurological signs or sciatic nerve root irritation, treated with manipulation alone. The study by Ongley (1987) included an injection of an experimental "proliferant" to the group treated with manipulation, and the effect of manipulation is impossible to determine. The trials of Evans (1978), Gibson (1985), and Waagen (1896) dealt with patients without neurological findings or sciatic nerve root ir-

ritation and had subacute or chronic back pain. Evans' trial is confounded by the crossover design; Gibson's study showed no benefit; and Waagen's study showed a benefit for manipulation, as compared to sham treatment, with improvement measured on the Visual Analogue Scale at 2 weeks. The study by Doran, which excluded minor neurologic findings and sciatic nerve root irritation but took patients with pain of all duration, showed a benefit for manipulation at 3 weeks when compared to controls (45% vs. 35% improved). In other studies, Potter (1977) reported an improvement in 64% of patients with chronic low-back pain and no leg involvement. Kirkaldy-Willis and Cassidy (1988) report their case series on patients with chronic pain; between 45% and 92% had good recovery, depending on their precise diagnosis.

In summary, the literature gives conflicting evidence on the value of spinal manipulation for patients with chronic low-back pain without neurological findings or sciatic nerve root irritation.

**Without minor neurological findings but with sciatic nerve root irritation.** No controlled trials examined the effect of manipulation in patients with chronic low-back pain without minor neurologic findings but with sciatic nerve root irritation.

**With minor neurological findings but without sciatic nerve root irritation.** The only controlled trial to examine this question is the second study of Meade (1990). This study randomized 375 of 717 patients with low-back pain of any duration, some of whom presumably had minor neurologic findings but none of whom had sciatic nerve root irritation, to "chiropractic care" or "medical care." The chiropractic-care group as a whole had significant improvements relative to the medical-care group in Oswestry Disability Questionnaire score at 6, 12, and 24 months. Stratified analysis showed that patients with pain of more than 1 month's duration responded equivalently to those with pain of shorter duration.

**With minor neurological findings and sciatic nerve root irritation.** Arkuszewski (1986) has reported the single controlled trial that included patients with only chronic low-back pain and minor neurological findings. Time to pain relief was improved by manipulation as compared to massage (3.1 vs. 3.8 weeks). More impressively, at 6 months 60% of the manipulated group had returned to work compared to 36% of the control group. These results are limited by the nonrandom assignment of treatment groups and the non-blinded assessment used. Glover (1974), and possibly Edwards (1969) and Sims-Williams (1978), also reported controlled trials of patients that included those with chronic pain and minor neurological findings with sciatic nerve root irritation. These studies showed a short-term benefit for manipulation that diminished at later follow-up. This diminution was usually due to improvement of the control group rather than deterioration of the manipulated group. In other studies, Mensor (1955), Chrisman (1964), and Kuo (1987) all reported case series of patients with chronic low-back pain and minor neurological findings with sciatic nerve root irritation. In Chrisman's study the patients also had documented disc protrusions. In Mensor's series of 205 cases, between 45% and 64% had excellent or good results, depending on insurance status (private or worker's compensation). The majority of the patients in Chrisman's study had an "excellent" or "good" improvement in pain relief (35/39); however, 10 of these ultimately had recurrence requiring operation. Kuo's series of 517 patients treated over 8 years yielded a 76.8% satisfactory response rate, with 14.1% recurrences. Operative findings in patients unresponsive to manipulation or who relapsed tended to show a central disc protrusion or a "huge" disc protrusion. Potter (1977) reported a 36% improvement in patients with chronic low-back pain and neurological findings. Lastly, in the case series of Kirkaldy-Willis and Cassidy (1988), chronic back pain from lesions associated with minor neurological findings and sciatic nerve root irritation had a response rate of between 50 and 60%.

In summary, the literature is not conclusive concerning the use of spinal manipulation for patients with chronic low-back pain with minor neurological findings and sciatic nerve root irritation.

**With major neurological findings.** No study, controlled or uncontrolled, has described the manipulative treatment of patients with chronic low-back pain and major neurological findings.

**With prior laminectomy.** There are no controlled trials of manipulation in patients with chronic low-back pain who have had previous laminectomy. Two case series, however, give somewhat conflicting results. In the series by Potter (1977), prior laminectomy did not alter the response of patients to manipulation with chronic low-back pain, with or without neurological findings. Kirkaldy-Willis and Cassidy (1988), however, report a 72% response rate in patients without prior laminectomy, and a 64% response rate in patients with prior laminectomy for patients with chronic back pain of all kinds.

**Additional issues.** With one exception, all studies of back pain that have shown duration of symptoms to be a predictor of response to treatment with spinal manipulation have shown the duration of symptoms to be inversely related to the likelihood of response. Bronfort (1986) reported that patients with a shorter duration of symptoms were more likely to respond to chiropractic treatment (15% vs. 65% not cured within 6 months for patients with less than 7 days of initial pain vs. more than 28 days). Similar results were shown by Maitland (1957), Glover (1974), Evans (1978), Potter (1977), and Sims-Williams (1978).

With regard to biomechanical and psychosocial stress, Bronfort showed that the presence of psychological overlay (as defined by the hysteria and hypochondriasis scores on the MMPI), as well as the presence of improper working posture, were associated with poorer response to chiropractic manipulation. The association of these factors with troublesome chronic back pain is well recognized in the medical community (Kirkaldy-Willis, 1988; Frymoyer, 1988).

As discussed in the section on acute low-back pain, spinal manipulation has not been shown to reduce a herniated nucleus pulposus physically. Please refer to the discussion on Additional Issues in the section on acute low-back pain for a review of the literature.

The Quebec Task Force concluded that spinal manipulation is contraindicated in the presence of radicular compression. This is also discussed under Additional Issues in the section on acute low-back pain.

Central spinal stenosis has not been subjected to a controlled trial of manipulative therapy. The discussion under Additional Issues in the section on low-back pain analyzes this topic in more detail.

## OTHER CONCERNS

### Treatment Duration

The scientific literature is not helpful in deciding when a patient should stop being treated with spinal manipulation, either with respect to improvement or worsening of symptoms. The literature reports controlled trials or case series with between 1 and 19 sessions of manipulation lasting anywhere from a single day to 2 months. It is unclear how many, if any, manipulations are necessary after the patient has become pain-free. There is more guidance concerning the patient who is not improving. The utilization guidelines developed by Hansen (1988) define indications for a second opinion to be:

- Treatment of three times a week that exceeds 4 weeks
- No objective or subjective signs of improvement, or worsening of condition, in first 2 weeks.

These recommendations are based on consensus among clinicians and have no experimental evidence to support them. They also only apply to acute or subacute low-back pain from a recent injury. There is no guidance with respect to chronic back pain or to pain not due to an injury.

The Ohio State Chiropractic Association, in their guidelines for utilization, list the parameters in Table 2 as a general guide for care.

La Brot (1989), in his privately published monograph, suggested the following number of visits and treatment duration listed in Table 3.

All of these recommendations, whether by individuals or by consensus, are based on clinical experience and opinion, without rigorous scientific support.

**Table 2**

**OHIO STATE CHIROPRACTIC ASSOCIATION GUIDELINES  
FOR FREQUENCY AND DURATION OF TREATMENT**

Conditions	Frequency (number of treatments /time period)	Duration
<b>Acute</b>		
Mild	daily to 3/week	up to 30 days
Moderate	3/week	up to 30 days
	1-2/month	up to 3 months
Severe	3/week	up to 3 months
	1-2/month	up to 5 months
<b>Chronic</b>		
Mild	3/week	up to 2 months
	1-2/month	up to 6 months
Moderate	3/week	up to 2 months
	1-2/month	up to 12 months
Severe	3/week	up to 4 months
	1-2/month	up to 18 months

**Table 3**

**LA BROT'S GUIDELINES FOR FREQUENCY  
AND DURATION OF TREATMENT**

Injuries	Number of Office Visits	Treatment Duration
<b>Traumatic</b>		
Mild	9-17	4 weeks
Moderate	19-45	up to 6 months
Severe	39-68	up to 12 months
<b>Non-Traumatic</b>		
Mild	5-12	4 weeks
Moderate to severe	14-28	up to 12 weeks

### **Clotting Disorders**

In many textbooks and reviews of chiropractic, the presence of clotting disorders (specifically in reference to patients taking therapeutic anticoagulants) is listed as a contraindication to manipulation. In reviews of the case reports of complications of manipulation, four cases, two serious (paraplegia from meningeal hematoma) and two nonserious (petechial rash or ecchymosis), were reported in patients with a clotting disorder who received spinal manipulation. As with other complications of spinal manipulation (see Complications), there is no way of knowing either the total number of complications due to clotting disorders or the number of patients with clotting disorders undergoing manipulation. Thus there is no way of estimating the frequency with which adverse outcomes occur in this patient population.

### **Abdominal Aortic Aneurysm**

As with clotting disorders, this is listed in many textbooks and reviews of chiropractic as a contraindication to manipulation. No case reports of complications due to abdominal aortic aneurysm have been found.

### **Spondylolisthesis**

No controlled trials exist to determine the prognostic influence of spondylolisthesis on response to manipulation for back pain. Mirau (1987) reports that the response of patients with chronic low-back pain with and without spondylolisthesis is equivalent. There is no evidence that spinal manipulation can reduce a spondylolisthesis.



## Appendix

### CONTROLLED TRIALS OF SPINAL MANIPULATION

This appendix summarizes the salient features of the controlled trials of manipulation for treatment of back pain.

Author <sup>1,2</sup> (Year) (Country of Origin)	Duration of Pain <sup>3</sup>	Sciatic <sup>4,5</sup> Pain/SNI	Minor <sup>6</sup> Neurologic Findings	Palpatory <sup>7</sup> Findings	Manipulation Defined (Type)	# Manipulated/ Total Sample <sup>8</sup> (# of Manip.) <sup>9</sup>	Results
Coyer (1955) (Britain)	A	Excluded	Excluded	None	Yes (Cyriax)	76/136 (1)	50% of manipulated group pain free at 1 week compared to 27% of controls treated with bedrest; values for 6 weeks were 88% and 72%, respectively
Edwards (1969) (Australia)	Not defined	Included/ presumably included	Presumably included	None	Yes (Maitland)	92/184 (13 max.)	No overall difference between manipulation and heat/massage, but manipulation improved those with sciatic pain and provided relief in half (4.8 vs. 9.7) the number of treatments
Glover (1974) RCT (Britain)	A/S+C	Included/not stated	Included	Yes	Yes (Rotational)	43/84 (1)	In general no difference between manipulation and diathermy vs. diathermy alone, manipulation provided better pain relief for those with <7 days of pain and first attack of back pain (61% vs. 42% mean pain relief at 3 days)
Doran (1975) RCT (Britain)	A, S, C	Excluded	Excluded	No	No	116/456 (6 avg.)	No difference between manipulation, physiotherapy, corset, and analgesics, using chi-square; later re-analysis by Hoehler (1987) showed statistical benefit for manipulation (45% vs. 35% improved at 3 weeks)

Author <sup>1,2</sup> (Year) (Country of Origin)	Duration of Pain <sup>3</sup>	Sciatic <sup>4,5</sup> Pain/SNI	Minor <sup>6</sup> Neurologic Findings	Palpatory <sup>7</sup> Findings	Manipulation Defined (Type)	# Manipulated/ Total Sample <sup>8</sup> (# of Manip.) <sup>9</sup>	Results
Bergquist (1977) RCT (Sweden)	Mainly A, some S	Included/in- cluded	Presumably excluded	Yes	Yes (Janda)	72/217 (variable)	"Combined physiotherapy" including manipulation or "back school" better than diathermy (time to re- covery 15.8, 14.8, and 28.7 days, respectively)
Evans (1978) RCT (Britain)	S, C	Included/ex- cluded	Probably excluded	No	Yes (Rotational)	32 (3 weeks)	Statistically significant improvement for manipula- tion vs. codeine in overall pain score for each group, older patients did better than younger, but crossover design, randomization failure make conclusions questionable
Sims-Williams (1978) RCT (Britain)	Not speci- fied	Included/ not stated	Included	Yes	Yes (Maitland)	47/94 (14 max.)	Significant improvement for manipulation vs. diathermy in return to light work at one month; ef- fect was gone by three months; pain <1 month re- sponded better
Rasmussen (1979) RCT (Denmark)	A	Excluded	Probably excluded	No	Yes (Rotational)	12/24 (2 weeks)	Distinct benefit for manipulation vs. diathermy, though non-blinded assessment (10/12 improved with manipulation vs. 3/12 in control group)
Hoehler (1981) RCT (USA)	52% A 17% C	Not stated	Not stated	Yes	Yes (Rotational)	56/95 (5 avg.)	Immediate benefit of manipulation vs. sham (84% vs. 68% pain relief); gone by 3 weeks; sophisticated control group
Coxhead (1981) RCT (Britain)	Mainly S	Only/Pre- sumably included	Presumably included	No	Yes (Maitland)	155/322 (14 max.)	Manipulation possibly slightly better than corset, back school, or traction, certainly better than no treatment, at 4 weeks; gone at 4 months. Later re- analysis by Hoehler (1987) showed statistically sig- nificant benefit of manipulation (82% vs. 73% im- proved) at 4 weeks
Zylbergold (1981) RCT (Canada)	Not stated	Not stated	Excluded	No	No	8/28 (2/week for 4 wk)	Manipulation no better than heat and physical ther- apy or traction in functional status at 4 weeks



Author <sup>1,2</sup> (Year) (Country of Origin)	Duration of Pain <sup>3</sup>	Sciatic <sup>4,5</sup> Pain/SNI	Minor <sup>6</sup>		Palpatory <sup>7</sup> Findings	Manipulation Defined (Type)	# Manipulated/ Total Sample <sup>8</sup> (# of Manip.) <sup>9</sup>	Results
			Neurologic Findings	Included/Excluded				
Nwuga (1982) RCT (Nigeria)	A	Only/pre- sumably in- cluded	Included	Included	No	Yes (Oscillatory rotation)	26/51 (12 max.)	Significant benefit for manipulation vs. diathermy for total rotation and straight leg raising compared to baseline for each group, NOT between groups. Significantly shorter time to pain relief for manipulated group (121 min. vs. 160 min. combined total treatment time)
Farrell (1982) RCT (Australia)	A	Included/ presumably included	Excluded	Excluded	No	Yes (Maitland)	24/48 (9 max.)	Short term benefit for manipulation vs. diathermy, exercises, and instructions; shorter time to pain relief (3.5 vs. 5.8 treatments); no difference in groups at 3 weeks
Godfrey (1984) RCT (Canada)	A	Not stated	Not stated	Not stated	Yes	Yes (Maigne)	22/81 (5 max.)	Trend toward benefit from manipulation vs. massage; later reanalysis by Hoehler (1987) showed statistically significant benefit for manipulation for back mobility (30% vs. 15%), but not overall symptomatology at 2 weeks; chiropractor and M.D. manipulator
Gibson (1985) RCT (Britain)	S, C	Probably ex- cluded	Excluded	Excluded	No	Yes (Minimal rotation)	41/109 (4 max.)	No benefit in subjective or objective outcomes immediately and at 2, 4, and 12 weeks; control groups received diathermy
Arkuszewski (1986) (Poland)	C	Included/ in- cluded	Included	Included	No	No	50/100 (6 avg., 10 max.)	Time to pain relief improved for manipulation vs. massage (3.1 vs. 3.8 weeks); at 6 months, 60% of manipulated group vs. 36% of control group had returned to old job; results limited by nonblinded assessment
Waagen (1986) RCT (USA)	S,C	Excluded	Excluded	Excluded	No	Yes (Chiropractic adjustments)	9/19 (4 avg.)	Benefit for manipulation vs. sham on Visual Analogue Scale measurements of pain immediately and at 2 weeks (0.6 and 1.7 difference between groups on VAS immediately and at 2 weeks, respectively); manipulations were given by chiropractor; 10 dropouts from enrollees

Author <sup>1,2</sup> (Year) (Country of Origin)	Duration of Pain <sup>3</sup>	Minor <sup>6</sup> Sciatic <sup>4,5</sup> Pain/SNI	Neurologic Findings	Palpatory <sup>7</sup> Findings	Manipulation Defined (Type)	# Manipulated/ Total Sample <sup>8</sup> (# of Manip.) <sup>9</sup>	Results
Meade (1986) RCT (Britain)	A,S,C	Not ex- cluded/ excluded	Included	No	No	23/50 (unknown)	Mean improvement in Oswestry Score between 0 and 6 weeks was 3.0 for those treated at medical clinic with exercises, traction, hydrotherapy, and possibly manipulation vs. 10.7 for those treated at chiropractic clinic; chiropractic manipulation
Ongley (1987) RCT (USA)	C	Excluded	Not ex- cluded	No	Yes (Sacroiliac lumbar roll)	40/81 (1)	Experimental group had significantly better outcomes on validated questionnaire; addition of injection of "proliferant" to experimental subjects makes interpretation of effect of manipulation alone difficult
Hadler (1987) RCT (USA)	Mainly A, some S	Included/ presumably included	Included	No	Yes (Lumbar rota- tion)	28/54 (1)	No overall difference in validated back pain questionnaire between manipulation and mobilization, but patients with pain of 2 to 4 weeks duration achieved a 50% reduction in pain score more rapidly with manipulation than with mobilization
Mathews (1987) RCT (Britain)	A, S	Included/in- cluded	Excluded	Yes	Yes (Rotation; straight thrust)	165/291 (up to 10)	Benefit for manipulation in patients with straight leg raising signs both subjectively and objectively at 2 weeks (30% difference in recovery rate); controls were given infrared heat. Patients without straight leg raising signs improved greatly in all groups, trend favoring manipulation but not significant; no difference at one year

Author <sup>1,2</sup> (Year) (Country of Origin)	Duration of Pain <sup>3</sup>	Sciatic <sup>4,5</sup> Pain/SNI	Minor <sup>6</sup> Neurologic Findings	Palpatory <sup>7</sup> Findings	Manipulation Defined (Type)	# Manipulated/ Total Sample <sup>8</sup> (# of Manip.) <sup>9</sup>	Results
Meade (1990) RCT (Britain)	A, S, C	Not ex- cluded/ex- cluded	Presumably included	No	No	375/717 (9 avg.)	Comparison of "chiropractic care" vs. "medical clinic care" for patients with back pain; 99% of chiropractic patients were manipulated, some medical patients were manipulated as well. Significantly greater improvement in Oswestry Score in chiropractic group at 6, 12, and 24 months; improvement in physiologic variables greater for chiropractic group as well. Patients with subacute and chronic pain improved similarly to those with acute pain.

## NOTES:

<sup>1</sup>First author and year of publication are provided for each study.

<sup>2</sup>Studies designated RCT had random allocation of subjects.

<sup>3</sup>A=Acute; S=Subacute; C=Chronic.

<sup>4</sup>Inclusion or exclusion of patients with typical sciatic pain is listed; "only" refers to studies which included only patients with sciatic pain.

<sup>5</sup>SNI means sciatic nerve root irritation, defined as typical sciatic pain and a positive ipsilateral straight leg raising sign (positive = pain distal to knee).

<sup>6</sup>Minor neurologic findings are one of the following: decreased ankle reflex, dermatomal sensory deficit, or nonprogressive motor weakness.

<sup>7</sup>Palpatory findings refers to the use of specific physical findings thought to be indicative of joint fixation as a criterion for entry.

<sup>8</sup>"# manipulated" refers to the number of subjects in the manipulation group.

<sup>9</sup>"# of manip." refers to the number of manipulative sessions during the study.



## REFERENCES

- "A Study of Chiropractic Worldwide," *FACTS Bulletin*, Vol. 3, 1989, p. 32.
- Arkuszewski, Z., "The Efficacy of Manual Treatment in Low Back Pain: A Clinical Trial," *Manual Medicine*, Vol. 2, 1986, pp. 68-71.
- Bergquist-Ullman, M., "Acute Low Back Pain in Industry," *Acta Orthopaedica Scandinavia (Suppl)*, Vol. 170, 1977, pp. 1-117.
- Bonica, J. J., "The Nature of the Problem," *Management of Low Back Pain*, H. Carrom and R. E. McLaughli (eds.), PSG Publishing Co, Inc., Littleton, MA, 1982, pp. 1-15.
- Branson, M. H., and A. A. Buerger, "Randomized Clinical Trials in the Validation of Cervical and Lumbar Manipulation," *Concepts and Mechanisms of Neuromuscular Functions*, Springer-Verlag, New York, 1984, pp. 90-105.
- Bronfort, G., "Chiropractic Treatment of Low Back Pain: A Prospective Survey," *Journal of Manipulative and Physiological Therapeutics*, Vol. 9, 1986, pp. 99-113.
- Brunarski, D. J., "Clinical Trials of Spinal Manipulation: A Critical Appraisal and Review of the Literature," *Journal Manipulative Physiological Therapeutics*, Vol. 7, 1984, pp. 243-249.
- Buerger, A. A., "A Non-Redundant Taxonomy of Spinal Manipulative Techniques Suitable for Physiologic Explanation," *Manual Medicine*, 1984, pp. 54-58.
- Buerger, A. A., and P. E. Greenman (eds.), *Empirical Approaches to the Validation of Spinal Manipulation*, Charles C. Thomas, Springfield, IL, 1985.
- Burton, K. A., "Back Pain in Osteopathic Practice," *Rheumatology and Rehabilitation*, Vol. 20, 1981, pp. 239-246.
- Cassidy, J. D., G. E. Potter, and W. H. Kirkaldy-Willis, "Manipulative Management of Back Pain in Patients with Spondylolisthesis," *The Journal of the CCA*, 1978, pp. 15-20.
- Chrisman, D., A. Mitnacht, and G. A. Snook, "A Study of the Results Following Rotatory Manipulation in the Lumbar Intervertebral-Disc Syndrome," *The Journal of Bone and Joint Surgery*, Vol. 46, 1964, pp. 517-524.
- Cox, J. M., *Low-Back Pain: Mechanisms, Diagnosis and Treatment*, 5th ed., Williams and Wilkins, Baltimore, MD, 1990.
- Cox, J. M., K. A. Fromelt, and S. Shreiner, "Chiropractic Statistical Survey of 100 Consecutive Low Back Pain Patients," *Journal of Manipulative and Physiological Therapeutics*, Vol. 6, 1973, pp. 117-128.

- Cox, J. M., and S. Shreiner, "Chiropractic Manipulation in Low Back Pain and Sciatica: Statistical Data on the Diagnosis, Treatment and Response of 576 Consecutive Cases," *Journal of Manipulative and Physiological Therapeutics*, Vol. 7, 1984, pp. 1-11.
- Coxhead, C. E., H. Inskip, T. W. Meade, et al., "Multicentre Trial of Physiotherapy in the Management of Sciatic Symptoms," *Lancet*, Vol. 1, 1981, pp. 1065-1068.
- Coyer, A. B., and I. Curwin, "Low Back Pain Treated by Manipulation," *British Medical Journal*, Vol. 1, 1955, pp. 705-707.
- Curtis, P., "Spinal Manipulation: Does it Work?," *Occupational Medicine*, Vol. 3, 1988, pp. 31-44.
- Deyo, R. A., "Conservative Therapy for Low Back Pain," *JAMA*, Vol. 250, 1983, pp. 1057-1062.
- Deyo, R. A., and Y. Tsui-Wu, "Descriptive Epidemiology of Low Back Pain and Its Related Medical Care in the United States," *Spine*, Vol. 12, 1987, pp. 264-268.
- Doran, D., and D. J. Newell, "Manipulation in the Treatment of Low Back Pain: A Multicentre Study," *British Medical Journal*, Vol. 2, 1975, pp. 161-164.
- Edwards, B. C., "Low Back Pain and Pain Resulting From Lumbar Spine Conditions: A Comparison of Treatment Results," *Australian Journal Physiology*, Vol. 15, 1969, pp. 104-110.
- Evans, D. P., M. S. Burke, K. N. Lloyd, et al., "Lumbar Spinal Manipulation on Trial: Part 1—Clinical Assessment," *Rheumatology and Rehabilitation*, Vol. 17, 1978, pp. 46-53.
- Farrell, J. P. and L. T. Twomey, "Acute Low Back Pain: Comparison of Two Conservative Treatment Approaches," *Medical Journal Australia*, Vol. 1, 1982, pp. 160-164.
- Fisk, J. W., "A Controlled Trial of Manipulation in a Selected Group of Patients with Low Back Pain Favouring One Side," *New Zealand Medical Journal*, Vol. 90, 1979, pp. 288-291.
- Frymoyer, J. W., "Back Pain and Sciatica," *The New England Journal of Medicine*, Vol. 318, 1988, pp. 291-300.
- Gallinaro, P., "Three Cases of Lumbar Disc Rupture and One of Cauda Equina Associated with Spinal Manipulation (Chiropraxis)," *Lancet*, 1973, p. 411.
- Gibson, T., R. Grahame, J. Harkness, et al., "Controlled Comparison of Short-Wave Diathermy with Osteopathic Treatment in Non-Specific Low Back Pain," *Lancet*, Vol. 2, 1985, pp. 1258-1260.

- Glasgow, E. F., L. T. Twomey, E. R. Scull, A. M. Kleynhans, and R.M. Idczak (eds.), *Aspects of Manipulative Therapy*, 2nd ed., Churchill Livingstone, Inc., New York, 1985.
- Glover, J. L., J. G. Morris, and T. Khosla, "Back Pain: A Randomized Clinical Trial of Rotational Manipulation of the Trunk," *British Journal of Industrial Medicine*, Vol. 31, 1974, pp. 59–64.
- Godfrey, C. M., P. P. Morgan, and J. Schatzker, "A Randomized Trial of Manipulation for Low Back Pain in a Medical Setting," *Spine*, Vol. 9, 1984, pp. 301–304.
- Grayson, M. F., "Horner's Syndrome After Manipulation of the Neck," *British Medical Journal*, Vol. 295, 1987, pp. 1381–1382.
- Greenland, A., L. S. Reisbord, S. Haldeman, and A. A. Buerger, "Controlled Clinical Trials of Manipulation: A Review and a Proposal," *Journal of Occupational Medicine*, Vol. 22, 1980, pp. 670–676.
- Grieve, G. P., *Mobilisation of the Spine: Notes on Examination, Assessment and Clinical Method*, 4th ed., Churchill Livingstone, New York, 1984, pp. 227–234.
- Hadler, N. M., P. Curtis, D. B. Gillings, and S. Stinnett, "A Benefit of Spinal Manipulation as Adjunctive Therapy for Acute Low Back Pain: A Stratified Controlled Trial," *Spine*, Vol. 12, 1987, pp. 703–706.
- Haldeman, S. C., "Spinal Manipulative Therapy," *Clinical Orthopaedics and Related Research*, Vol. 179, 1983, pp. 62–70.
- Haldeman, S. C., "Spinal Manipulative Therapy in Sports Medicine," *Clinics in Sports Medicine*, Vol. 5, 1986, pp. 277–293.
- Hansen, D. T., "Chiropractic Standards of Practice and Utilization Guidelines in the Care and Treatment of Injured Workers," Chiropractic Advisory Committee, Department of Labor and Industries, State of Washington, 1988.
- Hoehler, F. K., J. S. Tobis, and A. A. Beurger, "Spinal Manipulation for Low Back Pain," *JAMA*, Vol. 245, 1981, pp. 1835–1838.
- Hoehler, F. K., and J. S. Tobis, "Appropriate Statistical Methods for Clinical Trials of Spinal Manipulation," *Spine*, Vol. 12, 1987, pp. 409–411.
- Hooper, J., "Low Back Pain and Manipulation: Paraparesis After Treatment of Low Back Pain by Physical Methods," *The Medical Journal of Australia*, 1973, pp. 549–551.
- Kane, R. L., C. Leymaster, D. Olsen, F. R. Woolley, and F.D. Fisher, "Manipulating the Patient: A Comparison of the Effectiveness of Physician and Chiropractor Care," *Lancet*, 1974, pp. 1333–1336.

- Kirkaldy-Willis, W. H., *Managing Low Back Pain*, 2nd ed., Churchill and Livingstone, New York, 1988.
- Kirkaldy-Willis, W. H., and J. D. Cassidy, "Spinal Manipulation in the Treatment of Low-Back Pain," *Canadian Family Physician*, Vol. 31, 1985, pp. 535-540.
- Kornberg, E., "Lumbar Artery Aneurysm with Acute Aortic Occlusion Resulting From Chiropractic Manipulation: A Case Report," *Surgery*, 1988, pp. 122-124.
- Kuo, P. P., and Loh, Z., "Treatment of Lumbar Intervertebral Disc Protrusions by Manipulation," *Clinical Orthopedics and Related Research* No. 215; 1987, pp. 47-55.
- LaBrot, T., *A Standard of Care for the Chiropractic Practice*, 1989.
- Ladermann, J. P., "Accidents of Spinal Manipulations," *Annals of the Swiss Chiropractors' Association*, Vol. 7, 1981, pp. 161-208.
- Lewit, K., *Manipulative Therapy in Rehabilitation of the Locomotor System*, Butterworth's Scientific, Technical, Medical, Stoneham, MA, 1985.
- Maitland, G. D., "Low Back Pain and Allied Symptoms, and Their Treatment Results," *Medical Journal of Australia*, Vol. 44, 1957, pp. 851-854.
- Maitland, G. D., *Vertebral Manipulation*, 5th ed., Butterworth's Scientific, Technical, Medical, Stoneham, MA, 1986.
- Mathews, J. A., S. B. Mills, V. M. Jenkins, et al., "Back Pain and Sciatica: Controlled Trials of Manipulation, Traction, Sclerosant, and Epidural Injections," *British Journal of Rheumatology*, Vol. 26, 1987, pp. 416-423.
- Meade, T. W., et al., "Comparison of Chiropractic and Hospital Outpatient Management of Low Back Pain: A Feasibility Study," *Journal of Epidemiology and Community Health*, Vol. 40, 1986, pp. 12-17.
- Meade, T. W., et al., "Low Back Pain of Mechanical Origin: Randomised Comparison of Chiropractic and Outpatient Treatment," *British Medical Journal*, Vol. 300, 1990, pp. 1431-1437.
- Mensor, M. C., "Non-Operative Treatment, Including Manipulation, for Lumbar Intervertebral Disc Syndrome," *The Journal of Bone and Joint Surgery*, Vol. 5, 1955, pp. 925-936.
- Mierau, D., et al., "A Comparison of the Effectiveness of Spinal Manipulative Therapy for Low Back Pain Patients With and Without Spondylolisthesis," *Journal of Manipulative and Physiological Therapeutics*, Vol. 10, 1987, pp. 49-55.
- Mugge, R. H., "Persons Receiving Care from Selected Health Care Practitioners, United States, 1980," *National Medical Care Utilization and Expenditure Survey, Series B*,



- Descriptive Report No. 6., DHHS Pub. No. 84-20206, National Center for Health Statistics, Public Health Service, Washington, DC, U.S. Government Printing Office, Sept. 1984.
- Murt, H. A., P. E. Parsons, W.R. Harlan, et al., "Disability, Utilization, and Costs Associated with Musculoskeletal Conditions: United States," *1980 National Medical Care Utilization and Expenditures Survey*, Series C, Analytical Report No. 5, U.S. Dept. of Health and Human Services Publication No. 86-20405, National Center for Health Statistics, Public Health Service, Washington, DC, U.S. Government Printing Office, Sept. 1986.
- New Haven Health Care, Inc., National Chiropractic Center for Health Planning, Connecticut Chiropractic Association, Inc: Ambulatory chiropractic practice in Connecticut. Final report, Contract No. HSM 110-72-377, Health Services and Mental Health Administration, Department of Health, Education and Welfare, Washington, DC, 1976.
- Nwuga, V. C., "Relative Therapeutic Efficacy of Vertebral Manipulation and Conventional Treatment in Back Pain Management," *American Journal of Physical Medicine*, Vol. 61, 1982, pp. 273-278.
- Nyiendo, J., and S. Haldeman, "A Prospective Study of 2,000 Patients Attending a Chiropractic College Teaching Clinic," *Medical Care*, Vol. 25, 1987, pp. 516-527.
- Ohio State Chiropractic Association. *The Chiropractic Manual for Insurance Claims Personnel*, Ohio State Chiropractic Association, Columbus, OH, 1988.
- Ongley, M. J., R. G. Klein, T. A. Dorman, et al., "A New Approach to the Treatment of Chronic Low Back Pain," *Lancet*, Vol. 2, 1987, pp. 143-146.
- Kuo, P. P., and Z. Loh, "Treatment of Lumbar Intervertebral Disc Protrusions by Manipulation," *Clinical Orthopaedics and Related Research*, Vol. 215, 1987, pp. 47-55.
- Paris, S. V., "Spinal Manipulative Therapy," *Clinical Orthopaedics and Related Research*, Vol. 179, 1983, pp. 55-61.
- Phillips, R. B., and R. Butler, "Survey of Chiropractic in Dade County, Florida," *Journal of Manipulative and Physiological Therapeutics*, Vol. 83, 1982, pp. 83-89.
- Pima Health Systems, Inc., *1975 Ambulatory Care Survey*, Final report prepared for the American Chiropractic Association, November 1976.
- Potter, G. E., "A Study of 744 Cases of Neck and Back Pain Treated with Spinal Manipulation," *Journal of the Canadian Chiropractic Association*, 1977, pp. 154-156.
- Povlsen, U. J., L. Kjaer, and P. Arlien-Soborg, "Locked-In Syndrome Following Cervical Manipulation," *Acta Neurology Scandanavia*, Vol. 76, 1987, pp. 486-488.

- Rasmussen, G. G., "Manipulation in the Treatment of Low Back Pain—A Randomized Clinical Trial," *Manuelle Medizin*, Vol. 1, 1979, pp. 8–10.
- Richard, J., "Disk Rupture with Cauda Equina Syndrome After Chiropractic Adjustment," *New York State Journal of Medicine*, 1967, pp. 2496–2498.
- Scham, S. M., "Manipulation of the Lumbosacral Spine," *Clinical Orthopaedics and Related Research*, Vol. 101, 1974, pp. 146–150.
- Schneider, W., J. Dvorak, and T. Tritschler, *Manual Medicine Therapy*, 1988.
- Shekelle, P. G., and R. H. Brook, "A Community-Based Study of the Use of Chiropractic Services," *American Journal of Public Health*, Vol. 81, April 1991, pp. 439–442.
- Sheladia, V. L., and D. A. Johnston, "Efficacy of Various Chiropractic Treatments, Age Distribution and Incidence of Accident- and Non-Accident-Caused Low Back Pain in Male and Female Patients," *Journal of Manipulative and Physiological Therapeutics*, Vol. 9, 1986, pp. 243–247.
- Shvartzman, P., and A. Abelson, "Complications of Chiropractic Treatment for Back Pain," *Postgraduate Medicine*, Vol. 83, 1988, pp. 57–61.
- Sims-Williams, H., M. Jayson, S. Young, et al., "Controlled Trial of Mobilisation and Manipulation for Patients with Low Back Pain in General Practice," *British Medical Journal*, Vol. 2, 1978, pp. 1338–1340.
- Sims-Williams, H., M. Jayson, S. Young, et al., "Controlled Trial of Mobilisation and Manipulation for Low Back Pain: Hospital Patients," *British Medical Journal*, Vol. 2, 1979, pp. 1318–1320.
- Spitzer, W., et al., "Scientific Approach to the Assessment and Management of Activity-related Spinal Disorders," *Spine*, Vol. 12 (suppl), 1987, pp. S1–S59.
- Tobis, J. S., and F. Hoehler (eds.), *Musculoskeletal Manipulation: Evaluation of the Scientific Evidence*, Charles C. Thomas, Springfield, IL, 1986.
- Valentini, E., "The Rate of Success of Chiropractic Manipulations in Lumbar Herniated Discs," *Annals of the Swiss Chiropractors' Association*, 1965, pp. 79–85.
- Von Kuster, Jr., T., "Chiropractic Health Care: A National Study of Cost of Education, Service, Utilization, Number of Practicing Doctors of Chiropractic and Other Key Policy Issues," The Foundation for the Advancement of Chiropractic Tenets and Science, Washington, DC, 1980.
- Waagen, G. N., S. Haldeman, G. Cook, et al., "Short Term Trial of Chiropractic Adjustments for the Relief of Chronic Low Back Pain," Vol. 2, 1986, pp. 63–67.

Wilson, J. N., and F. W. Ilfeld, "Manipulation of the Herniated Disc," *American Journal of Surgery*, Vol. 83, 1952, pp. 173-175.

Zylbergold, R. S., and M. C. Piper, "Lumbar Disc Disease: Comparative Analysis of Physical Therapy Treatments," *Archives Physical Medicine Rehabilitation*, Vol. 62, 1981, pp. 176-179.









