

## MUSCULOSKELETAL MANIPULATION IN THE TREATMENT OF LOW BACK PAIN \*

JEROME S. TOBIS, M.D., AND FRED K. HOEHLER, PH.D.

Department of Physical Medicine and Rehabilitation  
University of California Irvine Medical Center  
Orange, California

**L**OW back pain is the most common complaint of adults next to the common cold. Approximately 80 % of adults suffer from back pain at some time in their lives.<sup>1</sup> Spinal manipulation as a treatment for low back pain is an ancient art widely employed since Hippocrates sanctioned its use.<sup>2</sup> Since then manipulation has had a varied popularity with many proponents and detractors. Practitioners from many disciplines use this procedure, including osteopaths, chiropractors, physicians, and physical therapists throughout the world. However, there is a remarkable paucity of experimental, controlled studies of the efficacy of this treatment.

The first major controlled clinical trial was reported in the medical literature in 1974.<sup>3</sup> Several trials have since been reported. Shortcomings of these trials have predominantly been that the studies were not and, in fact, could not be double blind. For any clinical trial to be truly double blind, the evaluator, the patient, and the treating clinician should not know what treatment was received. By this definition, double blind trials of manipulation are not possible because the treating clinician must be aware of the therapeutic modality employed. This is a problem in clinical trials of any therapy involving manual interaction between the patient and the treating clinician.

All previous studies that have demonstrated therapeutic value suffer from lack of adequate control for placebo effects. The use of analgesics or diathermy are inadequate controls for a therapeutic modality such as manipulation which may have a powerful placebo effect due to the "laying-on-of-hands". One study which found no therapeutic value for manipulation over other techniques of treatment<sup>4</sup> has been criticized because criteria for admission of patients to the trial were inadequate to

---

\*Presented at a combined meeting of the Section on Physical Medicine and Rehabilitation of the New York Academy of Medicine with the New York Society for Physical Medicine and Rehabilitation March 3, 1982.

Address for reprint requests: Department of Physical Medicine and Rehabilitation, University of California Irvine Medical Center, 101 South City Drive, Orange, CA 92668

select those for whom manipulation was appropriate. Thus, the treated group might have included many patients for whom the therapeutic procedures were of minimal benefit.

Our clinical trial differs from previous studies on two counts. First, we provided a "placebo" manual treatment. Soft tissue massage was employed as a placebo and it was demonstrated that the patients, none of whom had previous knowledge of spinal manipulation, probably could not distinguish one from the other modality. Second, patients were evaluated by experienced manipulators who selected only those subjects whom they considered most likely to benefit from manipulation. By this means, we believe that our clinical trial can meet favorably two of the major criticisms of previous trials. Our research has also been directed toward the development of objective measures relevant to spinal manipulation necessary for more precise measurement of the effects of manipulation on the pathological features associated with back pain. Finally, we shall report data that elucidate the relationship of manipulative treatment of back pain to the psychological state of the patient. Psychosomatic explanations of the effects of spinal manipulation have frequently been proposed, but there has been relatively little systematic investigation of this important field.

#### GENERAL METHODS

From 1973 to 1980 approximately 1,900 patients were examined at the Back Clinic of the University of California Irvine Medical Center. Of these, about 800 were referred elsewhere either because spinal manipulation was contraindicated or because alternative treatment was required (e.g., osteoporosis, bone infections, metabolic bone disease, fractures, carcinoma, ankylosing spondylitis, herniated nucleus pulposus, occlusive vertebral artery disease, etc.). The remaining patients were a pool of subjects for several studies on spinal manipulation in the treatment of low back pain.

Spinal manipulation was performed by physicians with extensive training in osteopathic manipulative procedures. The exact treatment procedures, of course, differed for each individual patient, but all patients participating in the studies reported here received a rotational manipulation of the lumbosacral spine. In this maneuver, the patient lies on his side on a table facing the manipulator. The inferior leg is extended and the superior leg is flexed, tilting the superior aspect of the pelvis toward the

manipulator. The superior shoulder is rotated away from the manipulator and the spine is locked in extension. A short high-velocity thrust is then applied to the pelvis. This procedure has been described in more detail by Mitchell<sup>5</sup> and Fisk.<sup>6</sup>

#### MEASUREMENT OF LOW BACK PAIN

Studies of spinal manipulative therapy are complicated because there is no generally accepted method to measure the disorders associated with low back pain. Usually, the investigator must resort simply to asking patients how they feel, a procedure always considered somewhat unsatisfactory because of its subjectivity. Although subjective data are not necessarily invalid or unreliable, it would be quite useful to develop a battery of quasi-objective tests relevant to low back pain and its treatment by spinal manipulation.

In a recently published study,<sup>7</sup> we examined a wide variety of possible measures. Included were anterior spinal flexion as described by Macrae and Wright,<sup>8</sup> lateral spinal flexion, hamstring tightness as described by Mitchell<sup>5</sup> and Fisk,<sup>9</sup> passive straight leg raising, active straight leg raising, and foot eversion as described by Retzlaff et al.<sup>10</sup> Except for anterior spinal flexion, each of these measures can yield both a general measure of flexibility (by summing the two sides) and a measure of asymmetry (by taking the difference between the two sides).

Table I indicates the reliability and validity of several measures of low back pain. The indicator of reliability was the Pearson  $r$  coefficient of correlation between results obtained by two independent examiners. For each patient, two examiners were randomly chosen from a pool of five participating physicians and there was, of course, no communication between them until all data were recorded. Correlation coefficients such as those shown in the first column of Table I may range from 1.0 (perfect correlation) to 0.0 (no correlation), to -1.0 (perfect negative correlation). Several measures, particularly those involving straight leg raising, are quite reliable while others, especially those of asymmetry, tend to show considerable variability when taken by more than one examiner.

Validity of the measures was assessed in two ways: ability to distinguish low-back-pain patients from patients without low-back pain and the tendency to approach "normal" values when low-back-pain patients receive a subjectively successful spinal manipulation. Data relevant to the first criterion are shown in column 2, while data relevant to the second

TABLE I. RELIABILITY AND VALIDITY OF SEVERAL MEASURES OF LOW BACK PAIN

	<i>Reliability*</i>	<i>Validity</i>	
		<i>Back pain**</i>	<i>Manipulation†</i>
<b>Tests of flexibility</b>			
Anterior flexion (cm.)	0.50**	2.3*	0.3
Lateral flexion	0.71**	7	1
Hamstring tightness	0.36*	5	5**
Passive SLR	0.78**	12*	5**
Voluntary SLR	0.95**	16*	4*
Foot eversion	0.63**	-1	0
<b>Tests of asymmetry</b>			
Lateral flexion	0.23	-0.3	1.5
Hamstring tightness	-0.04	-0.9	-1.9
Passive SLR	0.32	-1.3	-2.5
Voluntary SLR	0.44‡	-0.5	-4.0§
Foot eversion	0.38‡	-3.6	0.2

\* Pearson *r* correlation coefficient

\*\* Mean score of non-low-back-pain patients minus mean score of low-back-pain patients

† Mean score after manipulation minus mean score prior to manipulation

‡ *p* <0.05

§ *p* <0.01

criterion are shown in column 3. Only two of the quasi-objective measures (passive and voluntary straight leg raising) met all three criteria of acceptability and, therefore, these are the only ones that we can strongly recommend for evaluation of spinal manipulation therapy.

#### A CLINICAL TRIAL OF THE EFFICACY OF SPINAL MANIPULATION

The most important question about spinal manipulation is simply "does it work?" Is it useful in the treatment of low-back pain? Several recent clinical trials have demonstrated some efficacy when spinal manipulation is compared to no treatment or to such control treatments as simulated diathermy.<sup>3,11,12</sup> These studies may be criticized on the grounds that they have not adequately controlled for the powerful placebo effect that must accompany such a well-known manual treatment as spinal manipulation. A double-blind placebo control is, of course, impossible in this situation because the physician always knows which treatment he administers. However, we attempted to approach this ideal by carefully selecting patients without prior experience of manipulation and using a control treatment (soft tissue massage) which provided an equivalent level of manual interaction.

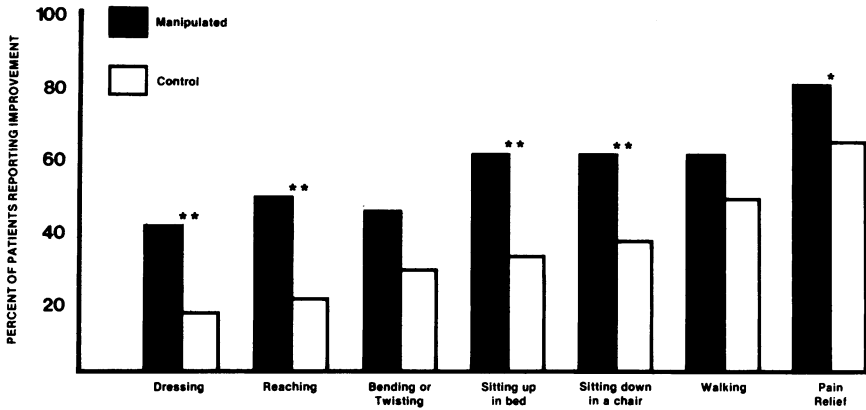


Fig. 1. Percentage of patients reporting improvement on various measures of spinal flexibility immediately after manipulative therapy or soft-tissue massage (control). \*\*= $p < 0.01$ , \*= $p < 0.05$ .

Figure 1 shows the responses of patients when asked if they had experienced relief from pain or an increased ability to perform several simple tasks immediately after the first treatment (manipulation or control). Manipulative therapy clearly results in substantial improvement not attributable to the effects of "laying-on-of-hands." Figure 2 shows that manipulation also significantly increased the angle of straight leg raising before pain occurred. However, by the time of discharge from the clinic, there was no difference between the two groups because each had shown substantial improvement. Thus, manipulation appears to be effective primarily in accelerating recovery from an episode of back pain. It should be noted that a questionnaire completed three weeks after discharge indicated that patients in the manipulated group were significantly ( $p < 0.05$ ) more likely to report that their treatment had been effective and no more likely than patients in the control group to report that they felt that they had received spinal manipulation.<sup>13</sup>

#### PSYCHOLOGICAL FACTORS IN SPINAL MANIPULATION

Successful alleviation of low back pain by spinal manipulation has often been attributed to psychological factors rather than to a direct local alteration of the physiological characteristics of the paraspinal region. To test this hypothesis, we requested patients to complete a short form of the Minnesota Multiphasic Personality Inventory (MMPI), the Mini-Mult.<sup>14</sup> The success of manipulation was assessed by the patient's report both

immediately after treatment and five days later. There were several striking differences between the two time periods. First, the proportion of patients reporting relief from pain was reduced from 84 % immediately after treatment to 55 % five days later. Second, as shown in Figure 3, psychological factors measured by the MMPI were not correlated with the tendency to report immediate relief from pain, although five days after treatment the absence of pain relief significantly correlated with MMPI scores on hysteria, hypochondriasis, and functional low-back pain.<sup>15</sup> Similar correlations have been reported in studies of spinal fusion,<sup>16</sup> chemonucleolysis,<sup>17</sup> and neurosurgical treatment<sup>18</sup> for back pain. It appears that spinal manipulation can by itself reliably produce immediate relief from back pain, but the prevention of future relapse requires careful attention to psychological factors that may predispose the back pain to recur.

#### DISCUSSION

These studies of patients with back pain have provided us with information concerning the reliability and validity of a series of measures of flexibility and asymmetry, an opportunity to identify some of the psychological characteristics of patients with recurrent back pain, and evidence that musculoskeletal manipulation of patients with back pain will usually result in immediate relief after a single treatment.

One study investigated several objective measures that attempt to determine the degree of movement, flexibility, or asymmetry of motion. Of the tests shown in Table I, reliability between examiners for all of the tests of flexibility and two of the tests of asymmetry was significant. However, only the tests of straight leg raising, either passive or voluntary, displayed statistically significant values for validity. By this we mean that there is restriction of these parameters in patients with low back pain and evidence of significant improvement following such a therapeutic intervention as manipulation.

Our data further indicate that patients who fail to have long-lasting improvement from a single manipulation tend to have elevated scores on a short form of the MMPI in measures of neuroticism and anxiety. Whether this is cause or effect is difficult to establish. Thus, these scores may represent a response to back pain rather than a psychosomatic cause. However, our findings support the view that psychological factors are an important consideration predicting the efficacy of spinal manipulation for long-term relief of back pain.

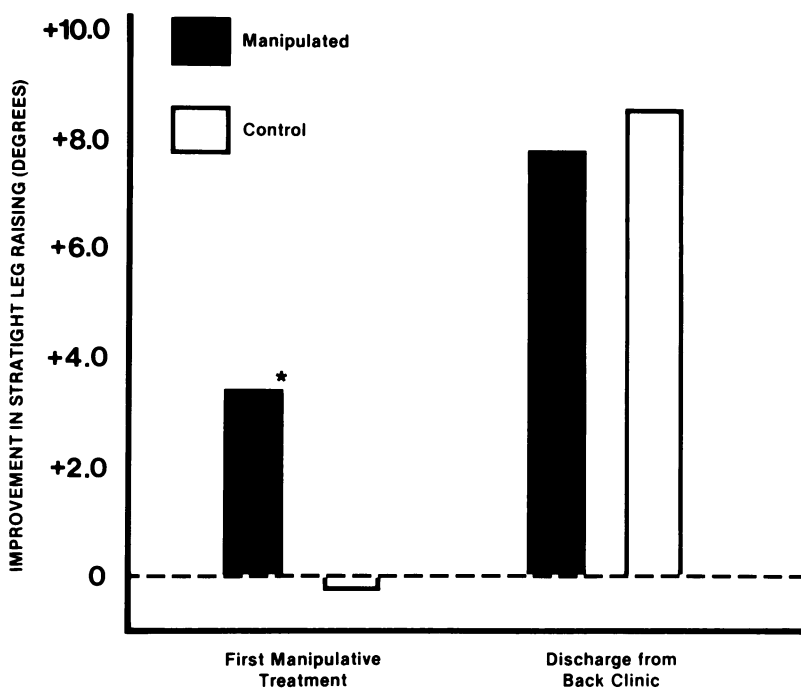


Fig. 2. Effect of manipulative therapy versus soft-tissue massage (control) on increases in the angle of straight-leg raising immediately after the initial treatment and at the time of discharge from the back clinic. \*= $p < 0.05$ .

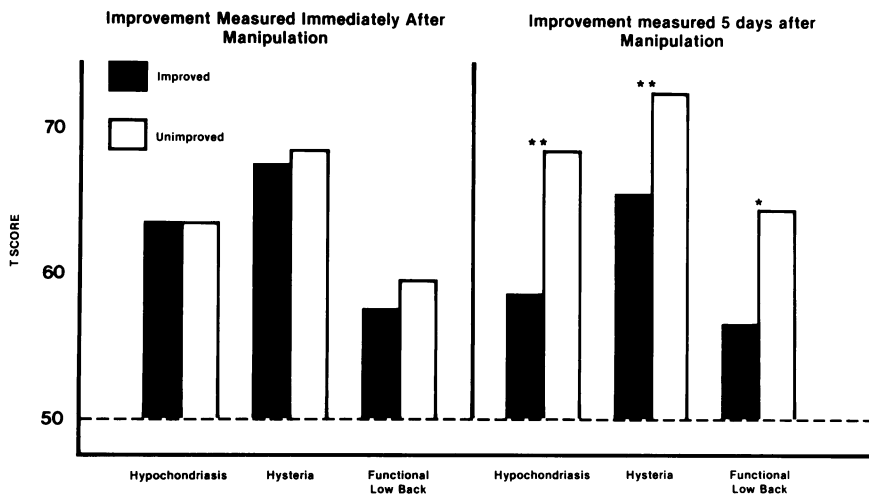


Fig. 3. MMPI equivalent T scores in patients who reported improvements versus patients who reported no improvement from manipulative therapy.

Finally, our data show that spinal manipulation does provide immediate subjective relief of low back pain. Such relief is significantly greater than that produced by a placebo consisting of soft tissue massage. We found that, despite the difference in reported relief, patients could not discern the nature of the treatment which they had received. Therefore, soft tissue massage appears to be an adequate control for evaluating the efficacy of manipulation treatment. Although the design of our study could not be designated as double blind by the very nature of the methods employed, nonetheless we suggest that our control procedure may be among the best available for this type of clinical trial.

Finally, we note that no studies, including our own, have demonstrated any long-term beneficial effects of spinal manipulation. It should be emphasized that long-term effects have been investigated using only the crudest measures of improvement on highly heterogeneous groups of patients. Further, because of the high rate of spontaneous remission—approximately 80 % according to Nachemson<sup>1</sup>—long-term benefit may be quite difficult to demonstrate statistically. However, even if manipulation only serves to accelerate recovery, the importance of low back pain (both in economic terms and in terms of the quality of life) suggests that manipulation will play an increasing role in the medical treatment of musculoskeletal disorders.

#### REFERENCES

1. Nachemson, A.: Pathophysiology and Treatment of Back Pain: A Critical Look at the Different Types of Treatment. In: *Approaches to the Validation of Manipulation Therapy*, Buerger, A. A. and Tobis, J. S., editors. Springfield, Ill., Thomas, 1977, chap. 2, pp. 42-57.
2. Lomax, E.: Manipulative Therapy: An Historical Perspective. In: *Approaches to the Validation of Manipulation Therapy*, Buerger, A. A. and Tobis, J. S., editors. Springfield, Ill., Thomas, 1977, chap. 12, pp. 205-16.
3. Glover, J. R., Morris, J. G., and Khosla, T.: Back pain: A randomized clinical trial of rotational manipulation of the trunk. *Br. J. Ind. Med.* 31: 39-64, 1974.
4. Doran, D. M. L. and Newell, D. J.: Manipulation in the treatment of low back pain: A multicentre study. *Br. Med. J.* 2:161-64, 1975.
5. Mitchell, F. L.: *An Evaluation and Treatment Manual of Osteopathic Manipulative Procedure*. Kansas City, Mo., Institute for Continuing Education in Osteopathic Principles, 1973.
6. Fisk, J. W.: *A Practical Guide to the Management of the Painful Neck and Back: Diagnosis, Manipulation, Exercises, Prevention*. Springfield, Ill., Thomas, 1977.
7. Hoehler, F. K. and Tobis, J. S.: Low back pain and its treatment by spinal manipulation: Measures of flexibility and asymmetry. *Rheum. Rehab.* 21: 21-26, 1982.
8. Macrae, I. F. and Wright, V.: Measurement of back movement. *Ann. Rheum.*



- Dis.* 28:584-89, 1969.
9. Fisk, J. W.: The passive hamstring stretch test: Clinical evaluation. *N. Z. Med J.* 89:209-11, 1979.
  10. Retzlaff, E. W., Berry, A. H., Haight, A. S., et al: The piriformis muscle syndrome. *J. Am. Osteopath. Assoc.* 73:799-807, 1974.
  11. Evans, D. P., Burke, M. S., Lloyd, K. N., et al.: Lumbar spinal manipulation on trial: I. Clinical assessment. *Rheum. Rehab.* 17:46-53, 1978.
  12. Sims-Williams, H., Jayson, M. I. V., Young, S. M. S., et al.: Controlled clinical trial of mobilization and manipulation for patients with low back pain in general practice. *Br. Med. J.* 2: 1338-40, 1978.
  13. Hoehler, F. K., Tobis, J. S., and Buerger, A. A.: Spinal manipulation for low back pain. *J.A.M.A.* 245: 1835-38, 1981.
  14. Kincannon, J. C.: Prediction of the standard MMPI scale scores from 71 items: The Mini-Mult. *J. Consult. Clin. Psychol.* 32:319-35, 1968.
  15. Hoehler, F. K. and Tobis, J. S.: Psychological factors in the treatment of back pain by spinal manipulation. Submitted for publication.
  16. Wilfing, F. J., Klonoff, H., and Korkan, P.: Psychological, demographic and orthopaedic factors associated with prediction of outcome of spinal fusion. *Clin. Orthop. Rel. Res.* 90:153-60, 1973.
  17. Wiltse, L. L. and Rocchio, P. D.: Pre-operative psychological tests as predictors of success of chemonucleolysis in the treatment of the low back pain syndrome. *J. Bone Joint Surg.* 57-A:478-83, 1975.
  18. Blumetti, A. E. and Modesti, L. M.: Psychological predictors of success or failure of surgical intervention for intractable pain. In: *Advances in Pain Research and Therapy*, Bonica, J. and Albe-Fessard, D., editors. New York, Rouon, 1976, vol. 2, pp. 323-325.