

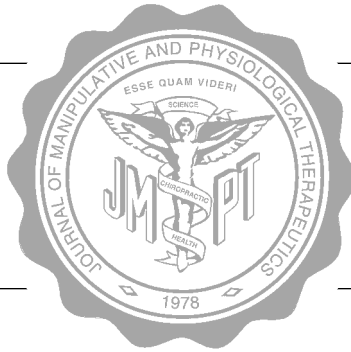


## Neurologic Effects of the Adjustment

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### ABSTRACT

This paper discusses the several theories pertaining to the chiropractic adjustment, including the nerve compression theory, reflex theories, and pain relief theories. There is now sufficient scientific research to consider these



theories reasonable working models to explain the effects of the adjustment but insufficient to consider them valid. (J Manipulative Physiol Ther 2000;23:112-4)

**Key Indexing Terms:** Chiropractic; Neurology; Pain

### INTRODUCTION

During the course of the World Chiropractic Congress in Auckland, New Zealand, much scientific evidence was presented in the field of spinal neurophysiology, which helps to form the basis for chiropractic theory and philosophy. There were also many panel discussions and workshops in which both traditional and modern theories on the pathophysiology of the subluxation and the effects of the adjustment on the nervous system were reviewed. It would be difficult to find a more learned and comprehensive panel of speakers or a more detailed discussion of the topic anywhere else in the world.

Listening to the scientific presentations and the philosophic panels, a number of issues became evident. First, there was an attempt by the scientific community to make their research meaningful by suggesting that this research be used as a logical clinical mechanism to explain the effects of the adjustment. There was a presumption by the philosophers and clinicians that the research was conclusive and could be used to justify the various theories on the pathophysiology of the subluxation. Close scrutiny of the data and the debate demonstrated the tenuous connection between the scientific research and the philosophic theories. A significant leap of faith is required to accept and present a convincing argument about the various theories on the neurologic effects of the adjustment.

### DISCUSSION

#### The Principles of Neurologic Theories of the Adjustment

In 1977, at a conference sponsored by the National Institute of Neurological and Communicative Disorders and Stroke on "The Neurobiological Mechanisms in Manipulative Therapy," I was asked to present a paper titled "The Clinical Basis for Discussions of Mechanisms of Manipulative Therapy"<sup>1</sup> to put the meager research available at that time in perspective. The basic criteria for judging a proposed neurobiologic mechanism of manipulation was laid out. Four criteria were presented. *Criterion I* stated that a specific manipulative procedure must demonstrate consistent clinical results under controlled conditions in the treatment of a specific pathologic process, organ dysfunction, or symptom complex. *Criterion II* stated that the specific manipulative process must demonstrate a specific effect on the musculoskeletal system to which it is applied. *Criterion III* stated that the musculoskeletal effect caused by the manipulation must be shown to have a specific influence on the nervous system. *Criterion IV* stated that the influence on the nervous system brought about by the manipulation must demonstrate a beneficial influence on abnormal function of an organ, tissue pathology, or symptom complex.

These criteria are illustrated in Fig 1 and remain as valid today as they were in 1977. Examining the current research and theory objectively requires determination of the strengths and weaknesses of each proposed neurologic effect of the adjustment.

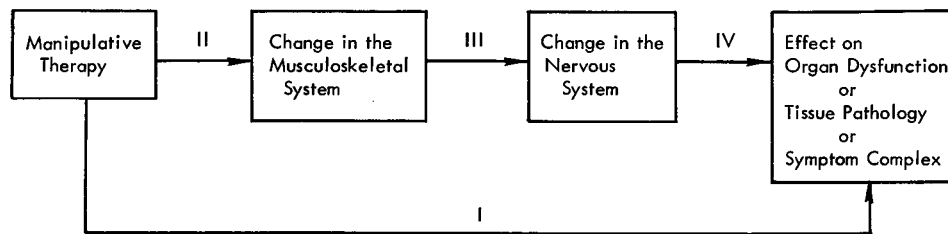
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#### Nerve Compression Theories for the Adjustment

The predominant theory on the effect of the adjustment is based on the concept of nerve compression. This theory proposes that the primary effect of the adjustment is to correct a subluxation. Subluxation is defined as an abnormal biomechanic relation among vertebrae that can cause compression



**Fig 1.** The 4 areas of research required to confirm a proposed neurobiologic mechanism of action of manipulative therapy. Adapted with permission from Haldeman.<sup>1</sup>

of spinal nerve roots that in turn causes interference with normal nerve root function resulting in pain or other clinical symptoms or pathology.

Giles<sup>2</sup> discussed in detail the various anatomic changes that can result in nerve root compression. He described the impact of osteophytes from the vertebral body, facet, and uncovertebral joints in narrowing the central canal and lateral recesses on spinal nerves. He also described the mechanism by which intervertebral disc herniations can compress nerve roots and mentioned some of the more esoteric mechanisms of nerve compression, including hypertrophy or calcification of ligaments. After this discussion, there can be little doubt that compression of nerve roots can occur in the spine.

Garfin<sup>3</sup> reviewed in detail the effect of compression on nerve function. He described the effect of nerve compression on intraneural pressure and venous circulation. He presented evidence that compression results in venular constriction, extravasation of proteins, capillary constriction followed by arteriolar constriction, and impairment of both afferent and efferent electrophysiologic function in the nerve root. The research on this topic has resulted in a marked increase in the understanding of the local effect of compression on the nerve root.

What is missing, however, is mention of a misalignment or subluxation as a cause of nerve compression. To date, there has been no evidence that a change in the relation of adjacent vertebrae of the type commonly described in the chiropractic literature can result in nerve root or spinal cord compression. There is also minimal evidence that the adjustment of a subluxation or manipulation of any spinal lesion can result in reduction of nerve root compression. It is therefore still not possible to consider the relief of nerve compression an established effect of the adjustment.

### Reflex Theories of the Adjustment

Reflex theory proposes that the subluxation be considered an aberrant biomechanic relation within the spine. Such aberrant relations are assumed to stimulate receptors in spinal and paraspinal tissues such as muscle ligaments and facets. The impulses generated by the stimulation of spinal structures presumably activate neural reflex centers within the spinal cord or higher centers that, in turn, cause somatovisceral responses in sympathetic and parasympathetic nerves or somato-somatic responses resulting in muscle spasm.

Bolton<sup>4</sup> reviewed the segmental afferent input from spinal structures in detail. Clearly, spinal structures are richly innervated. There are multiple sensory receptors in muscle,

ligaments, facet joints, paraspinal skin, the meninges, and the outer fibers of the intervertebral disc. These receptors are responsive to mechanical (position, motion, and tissue distortion), inflammatory (nociceptive), and temperature changes. Each spinal structure has its own neural receptors with different characteristics and sensitivities. Stimulation of these receptors has been shown to activate central reflex pathways and specific somato-somatic reflexes in experimental animals. Recent research by Herzog et al<sup>5</sup> has demonstrated that these reflexes, at least at the spinal level, can be brought about by a spinal adjustment.

Budgell<sup>6</sup> has added to the excitement surrounding reflex theory by reviewing the research, in particular that by Sato et al,<sup>7</sup> describing the response of visceral organs to somatic stimulation. There is now considerable evidence that the stimulation of somatic structures, including the skin and peripheral joints, can have substantial effects on cardiovascular, bladder, and gastrointestinal function in experimental animals. He further demonstrated the complexity of these reflexes, showing that they can be excitatory and inhibitory of visceral function and may act through spinal pathways and supraspinal and cortical centers.

There are, however, major obstacles to the acceptance of reflex theories as legitimate explanation for the effects of the adjustment. The major deficiency is that all the demonstrated reflex effects have been recorded during brief periods with experimental conditions. There remains minimal evidence that these reflexes continue for sufficient time to allow a true change in organ function or prolonged symptoms. There is also minimal clinical evidence that the adjustment actually causes changes in patients that could be attributed to these reflexes.

There is still a considerable amount of research that must be done to establish reflex theory as an accepted explanation for the effects of the adjustment.

### Pain Relief Theories for the Adjustment

The problems with pain relief theories for the adjustment are the opposite of those for reflex theories. There is now considerable evidence that patients who undergo treatment with manipulation or adjustments describe relief of their pain exceeding that achieved by other treatment methods. Much of the 1999 World Chiropractic Conference, in particular the workshops and grand rounds, presented clinical studies or case reports describing this effect of the adjustment. The problem, however, is the difficulty in explaining this effect on theoretic grounds.

Vernon<sup>8</sup> presented evidence suggesting that the adjustment can result in hypoalgesia. He presented evidence in favor of central facilitation from the stimulation of spinal structures, the ability of the adjustment to change cutaneous and muscular pain thresholds, and the conflicting evidence in favor of the release of endorphins. The problem with these theories, as pointed out, is that the observed changes can often be explained on the basis of psychophysiological mechanisms and may not be applicable to the long-term effects of the adjustment on spinal pain.

Some of the gaps have been filled in by demonstrating the biomechanic effects of the adjustment (J. Triano, oral communication, May 1999). The direct effects of the adjustment on the manner in which spinal structures respond to external forces have been described. The adjustment is believed to be primarily a mechanical force interacting with very dynamic spinal tissues. Only in the past few years have the biomechanic effects of the adjustment been investigated for their neural effects.

The major difficulty with the pain theories for the adjustment is that they do not always consider the poor understanding of the genesis of spinal pain. There is a tendency to explain the effects of the adjustment in terms of a singular cause for spinal pain (eg, disc herniation, facet fixation, or muscle spasm). However, until the relative importance of each of the various spinal structures in the generation of spinal pain is understood, it is unlikely that the exact mechanism by which the adjustment can relieve such pain will be established.

## CONCLUSION

The discussion of the neurologic effects of the adjustment is no longer a debate between believers and skeptics of any

specific theory. There is now sufficient scientific investigation to develop working models to explain the effects of the adjustment. However, there is insufficient evidence to state that any particular theory can be considered valid. What must be avoided at this stage of understanding of the neurologic effects of the adjustment is the unreasonable extrapolation of current knowledge into speculation and presentation of theory as fact.

## REFERENCES

1. Haldeman S. The clinical basis for discussion of the mechanisms of manipulative theory. In: Korr IM, editor. Neurobiological mechanisms in manipulative therapy. New York: Plenum Press; 1977. p. 53-75.
2. Giles LGF. Mechanisms of neurovascular compression within the spinal and intervertebral canals. Plenary paper for the 1999 World Chiropractic Congress. *J Manipulative Physiol Ther* 2000;23:107-11.
3. Garfin S. Pathology of spinal stenosis and HNP and related pain. Proceedings of the 1999 World Chiropractic Congress; 1999 May 20-22; Auckland, New Zealand.
4. Bolton PS. Reflex effects of vertebral subluxations: the peripheral nervous system. An update. *J Manipulative Physiol Ther* 2000;23:101-3.
5. Herzog W, Scheele D, Conway J. Electromyographic responses of back and limb muscles associated with spinal manipulative therapy. *Spine* 1999; 24:146-52.
6. Budgell BS. Reflex effects of subluxation: the autonomic nervous system. *J Manipulative Physiol Ther* 2000;23:104-6.
7. Sato A, Sato Y, Schmidt RF. The impact of somatosensory input on autonomic functions. *Rev Physiol Biochem Pharmacol* 1997;130:257-62.
8. Vernon H. Qualitative review of studies of manipulation-induced hypoalgesia. Plenary paper for the 1999 World Chiropractic Congress. *J Manipulative Physiol Ther* 2000;23:137-42.