Chiropractic Intervention in the Treatment of Joint and Soft Tissue Disorders

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Abstract/Résumé

The concept of manual therapy, specifically manipulation of the bodily joints as in the practice of chiropractic, can no longer be deemed an invalid system of health care. Practiced for over 2,000 years by a variety of ancient civilizations, the art of manipulation for the purpose of correcting and restoring joint function has continued to fluorish, despite opposition. The climate, however, is changing. The art of chiropractic is increasingly being seen as a uniquely devised and administered technique whereby high velocity, low amplitude thrusting maneuvers are specifically directed by the skilled practitioner toward spinal segments and peripheral articulations in an effort to correct aberrant mechanical function. The corrections are effected while utilizing the transverse and spinal processes of individual vertebrae as contacting levers. Hippocrates is credited with the advice to, "Look well to the spine for the cause of disease," as displaced or degenerative vertebrae may irritate spinal nerve roots while exiting the intervertebral foramina and, consequently, interfere with normal nerve function. Similarly, it is a fundamental precept of chiropractic philosophy that irritation of the nervous system by mechanical, chemical, or psychogenic means is considered as causative in the development of disease. The scientific evidence associated with chiropractic intervention in the treatment and management of musculoskeletal disorders and visceral diseases is growing. This paper discusses the history, philosophy, and efficacy of joint manipulation and its influence on the development of chiropractic treatment.

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Le concept de thérapie par les mains, ou plus spécifiquement, de manipulation des articulations corporelles comme en chiropraxie, système non reconnu en matière de soin de santé, ne peut plus être mis à part. Pratiqué par diverses civilisations anciennes depuis plus de 2000 ans, l'art de la manipulation à des fins de traitement et de restructuration, s'est répandu malgré ses détracteurs. Las attitudes changent néanmoins. L'art de la chiropraxie, avec son unique modèle d'opération et d'administration, est entre les mains d'un habile praticien de formation dont les manoeuvres de mobilisation, à faible amplitude mais à haute vélocité, sont appliquées aux segments vertébraux et aux articulations périphériques pour corriger une fonction mécanique défectueuse. Les corrections sont effectuées en se servant des apophyses vertébrales comme leviers de contact. Hippocrate a déjà dit: "Dans la recherche de la cause de la maladie, observez bien la colonne vertébrale," car une vertèbre déplacée ou dégénérescente peut irriter des racines de nerfs médullaires émanant du trou de conjugaison et, de ce fait, altérer la fonction normale du nerf. De même, un principe fondamental en philosophie chiropratique fait état que toute irritation du système nerveux au moyen d'agents mécaniques, chimiques ou psychogènes constitue une cause du développement de la maladie. Les observations scientifiques associées aux interventions chiropratiques pour le traitement des troubles musculo-squelettiques et des maladies viscérales s'accumulent. Cet article trace une brève historique et analyse la philosophie et l'efficacité de la manipulation articulaire et de son influence sur le développement des traitements chiropratiques.

Historical Perspectives

It is likely that the "laying on of the hands" was initially intended to soothe and comfort those who may have experienced trauma or were otherwise afflicted with any of a variety of ailments (Haldeman, 1989). Gentle stroking not only provides comfort to those distressed and ailing but also serves as psychological support and reassurance through the sense of touch. It is possible that manual stroking methods and massage techniques, as well as the practice of manipulation of the joints, including the spinal articulations, grew from such forms of treatment. The precise accounts of and rationales for the origins of manual therapies may never be known. However, it is known that the use of the hands as bona fide instruments of healing has been documented throughout history (Gibbons, 1980; Kamenetz, 1985; Lomax, 1975, 1976; Schiotz, 1958).

Some of the earliest records date to an ancient Chinese medical text written during the Han Dynasty approximately 2,000 years ago (Anderson, 1992). The Yellow Emperor's Classic of Internal Medicine—*Huang Ti Nei Ching Su Wen*—describes the use of massage and exercise. A more definitive explanation and illustration of manipulation was recorded in a text written in 1749, titled *I Tzung Chin Chien*, The Golden Mirror of Medicine (Anderson, 1992). In this case, treatment for the lumbar spine employed the use of gravity to assist in tractioning the patient, while the treating practitioner applied manual force to the lumbar vertebrae.

It is apparent, however, that the practice of spinal manipulation prior to the fifth century BC cannot be validated with certainty. The first physician to clearly describe spinal manipulative techniques was Hippocrates of Cos (circa 460–377 BC) (Anderson, 1992; Haldeman, 1989). In his book, *Corpus Hippocrateum*, two chapters titled Peri Arthron ("about joints") and Mochlikon ("the lever") detail manipulative procedures for the treatment of spinal scoliosis and gravity-assisted

spinal manipulation, which Hippocrates referred to as succussion, similar to the Chinese method outlined above (Lomax, 1975; Schiotz and Cyriax, 1975). Joint manipulation has been recognized as an approach to the treatment of musculoskeletal disorders over the centuries and has been practiced in ancient Asian societies, Western civilization, and throughout Europe (Anderson, 1992).

In 1895 Daniel David Palmer, a Canadian who had emigrated to the United States, developed the principles upon which chiropractic theory is based (Gibbons, 1976). Palmer's premise, that illness is essentially functional and becomes organic only as an end process, is finding wider acceptance today (Gibbons, 1980). A recent study funded by the Ontario Ministry of Health (Manga et al., 1993), which examined and compared cost-effectiveness, safety, and patient satisfaction, concluded that the case was overwhelmingly in favour of much greater use of chiropractic services in the management of low back pain. Chiropractic manipulative therapy has proven effective not only in treating back pain (Shekelle et al., 1992) but also in treating neck pain (Aker et al., 1996), headache (Boline et al., 1995; Vernon, 1982, 1988), and pain existing in nonspinal articulations as well (Vicenzino et al., 1996). However, studies on the efficacy of chiropractic treatment in influencing exercise-induced muscle damage and repair have yet to be performed.

There remains considerable skepticism—and to some extent ostracism of the practitioners of manipulation—on the part of mainstream medical practitioners. Due to its widespread popularity and the increasing utilization of chiropractic services by the general public, however, the role of chiropractic intervention and its place in the health care system is a topic of ongoing discussion (Gibbons, 1980). In this last decade of the 20th century, chiropractic has begun to shed its status as a marginal approach to health care and is becoming more mainstream.

There is debate, both within and outside the chiropractic profession, about whether chiropractic should be considered a nonsurgical musculoskeletal specialty or a broadly based alternative to medicine (Shekelle, 1998). According to Chapman-Smith (1997a), "At the individual level today, there is widespread cooperation between chiropractic and medicine at all levels of education, research and practice. In many North American cities, a large number of MDs and DCs practice in offices in the same health centre with close cooperation and inter-referral, often now in full and formal partnership" (p. 4).

The history of chiropractic is imbued with turbulence (Gibbons, 1976). Yet, as Gatterman (1990) states, "From humble beginnings at the close of the nineteenth century, chiropractic has grown to become the second largest healing profession in North America" (p. xvii). Shekelle (1998) ranks chiropractors as the third largest group of health care professionals who have primary contact with patients (after physicians and dentists). He notes that they are licensed to practice in all 50 states in the U.S., 45 states have mandated benefits for chiropractic services, and an increasing number of insurance plans and managed-care organizations cover chiropractic care. In Canada, chiropractors are licensed in all 10 provinces and some provincial health care plans cover a portion of costs for chiropractic care. As well, a variety of insurance programs cover chiropractic services, including The Workplace Safety and Insurance Board (formerly Workers' Compensation Board) and Veteran's Affairs Canada (in association with Blue Cross). The number of such plans and funding agencies continues to grow.

As for the future of chiropractic, Wardwell (1992) states,

> Now that barriers to professional intercommunication and cooperation are reduced, it remains to be seen what will be the impact of future changes in the health care system on chiropractic's fairly well-established status. With the vested interests that chiropractors now have in their system of higher education and their separate law and licensing boards, and considering their practice limitations in relation to the sacrosanct areas of controlled drugs and major surgery, it seems to me very unlikely that chiropractic will ever evolve toward fusion with the medical mainstream, as has osteopathy. (p. 286)

Chiropractic Practice and Practitioner Defined

D.D. Palmer, the founder of chiropractic, stated that this unique approach to the delivery of health care was to be considered a philosophy, a science, and an art (Wardwell, 1992). A contemporary definition of chiropractic states that it is "a branch of the healing arts specializing in the correction by spinal manual therapy" of what chiropractors identify as biomechanical disorders of the spinal column. They carry out spinal diagnosis and therapy at a sophisticated and refined level (Inglis et al., 1979). From another perspective, chiropractic may be viewed as,

> a science of applied neurophysiologic diagnosis based on the theory that health and disease are life processes related to the function of the nervous system: irritation of the nervous system by mechanical, chemical or psychic factors is the cause of disease; restoration and maintenance of health depend on normal function of the nervous system. Diagnosis is the identification of these noxious irritants and treatment is their removal by the most conservative method. (Anonymous, 1988, p. 316)

Specialized training consisting of approximately 4,000 hours of classroom, laboratory, and clinical education results in the development of a clinically competent practitioner of chiropractic. Spinal manual therapy in the hands of the trained chiropractor has proven to be a safe and effective method of treating biomechanical disorders of the spinal column (Inglis et al., 1979). Kelner and colleagues (1980) state that the hands of the chiropractor are used not only to allay pain but also to indicate its location and intensity for the patient. The aspect of touch and the laying on of the hands is what clearly distinguishes the chiropractic practitioner from other primary care personnel. In a comparative discussion, Kelner et al. point out,

> Although hand touch looms large in the repertoire of the nurse, it plays virtually no part in that of the surgeon, who generally touches the patient when he is anaesthetized. The physician, too, limits his touch contacts by emphasizing the use of technical instruments and laboratory tests. There is hardly any room for the use of the hands by the physician, either in treatment or in diagnosis. (p. 10)

As best as can be determined, manipulation, which likely derived from the application of various manual therapies outlined previously, was devised for the purpose of setting and replacing displaced bones and joints, particularly the spinal

articulations. Without dispute, it is one of the oldest therapeutic methods known. Manipulation may be defined as a passive maneuver in which specifically directed manual forces are applied to vertebral and extravertebral articulations of the body, the object being to restore mobility to restricted areas (Gatterman, 1990).

Philosophical Approach to Treatment

The mainstay of chiropractic clinical practice is the detection and correction of mechanical "lesions" of the spine and peripheral articulations. These palpable entities indicate spinal segmental or articular dysfunction and have been cited as the primary reason for local discomfort and pain (Breen, 1977; Nyiendo and Haldeman, 1987; Vear, 1972). Such biomechanical faults are referred to among chiropractors as "subluxations" (Gatterman, 1995); they are termed "somatic dysfunction" by osteopathic physicians (Greenman, 1978; Korr, 1986) and "fixation" or "functional blockage," or the more generic "hypomobility" in the terminology of manual medicine (Grieve, 1986; Haldeman, 1989). In terms of mechanical issues, the manipulable disorder can be characterized as a spinal joint strain/sprain with associated local and referred pain, muscle spasm, and functional derangement of the joint due to static misalignment and/or reduction of motion.

To standardize nomenclature within the chiropractic profession, two authoritative definitions of "chiropractic subluxation" have been developed. The first one is, "a motion segment in which alignment, movement integrity, and/or physiologic function are altered, although contact between the joint surfaces remains intact " (Chapman-Smith, 1997b, p. 3). This definition evolved through a formal consensus process involving input from clinicians, researchers, and educators (Gatterman, 1994).

During a 1996 meeting of the Association of Chiropractic Colleges, the following definition was derived with the support of all North American chiropractic college presidents: "A complex of functional and/or structural and/or pathological changes that compromise neural integrity and may influence organ systems function and general health. A subluxation is evaluated, diagnosed and managed through the use of chiropractic procedures based on the best available rational and empirical evidence" (p. 3). This latter definition is not limited to joint disorders but also implicates muscle dysfunction, psychological stress, or anything else functional or structural that might compromise neural integrity and general health (Chapman-Smith, 1997b).

Manipulations may consist of long-lever techniques that comprise high-velocity forces exerted on a point of the body some distance from the area where this procedure is expected to have its beneficial effect, and short-lever manipulations that comprise high-velocity thrusts directed specifically at an isolated joint (Gatterman, 1990). For the most part, chiropractors may use either form of manipulation, referred to as an "adjustment." In a more recent definition, Gatterman (1995) explains that manipulation is a manual procedure involving a directed thrust to move a joint past the physiological range of motion, without exceeding the anatomical limit. Generally, chiropractic adjustments involve high-velocity, low-amplitude thrusting procedures, where the contact is usually specific on a leverage advantage point on the motion segment, such as over the vertebral transverse process, spinous process, articular pillar, or the mammillary process (Grice and Vernon, 1992).

Biological Efficacy for Manipulation

When a force is applied to the bodily joints so as to distract them, such as in a chiropractic manipulative procedure, cracking or popping sounds may be heard. The adjustive procedures applied to joint structures at or near the end of the passive or physiologic range of motion, but not exceeding the anatomic limits of motion, are often accompanied by cracking sounds as the resultant physiologic response associated with such maneuvers (Grice, 1980; Sandoz, 1976).

Such "cavitations" have been investigated (Rosten and Wheeler-Haines, 1947; Unsworth et al., 1971). Analysis of the gas content of synovial fluid from human joints reported it to be 15% by volume, of which more than 80% was carbon dioxide (Unsworth et al., 1971). Using a Van Slyke apparatus, these authors reported gas reabsorption time to be approximately 30 minutes in a metacarpophalangeal joint, which is in agreement with the clinical observation that joints can only be recracked after about 20–30 minutes. This observation was also reported by Mierau et al. (1988), who identified the vacuum phenomenon and provided experimental evidence of increased range of motion following joint cavitation. Chiropractic adjustive maneuvers, resulting in cavitations, are said to occur in the paraphysiological space, which is said to be positioned between the end of passive range of motion (i.e., elastic barrier of resistance) and the limit of anatomical integrity of the joint (Sandoz, 1976).

Manual therapy may, by definition, include the notion of the application of manual force. Consequently, the distinction between manipulation and mobilization requires clarification. Mobilization is also a form of manual therapy but is applied singularly or repetitively within or at the physiological passive range of joint motion without imparting a thrust or impulse, with the goal of restoring joint mobility (Gatterman, 1995). The distinction between manipulation and mobilization is an important one due to the growing body of evidence suggesting that manipulation is more effective in treating low back pain (Bronfort, 1986), treating neck pain (Mierau and Cassidy, 1984), and improving spinal joint ranges of motion (Ottenbacher and Difabio, 1985).

Much earlier, clinician/researchers such as Mennell (1964) realized that loss of function in one joint may have far-reaching effects on the normal functioning of much of the rest of the musculoskeletal system. In fact, from a clinical perspective it is the rare patient with disease of the hip who does not suffer from some back pain. Many a late-developing symptom of musculoskeletal pain could be easily avoided if one knew better how to care for current joint problems (Mennell, 1964).

It is commonly observed clinically that the posttreatment effects of manipulation may be realized almost immediately (Glover et al., 1977; Hoehler et al., 1981). Consequently, the phenomenon of probable pain threshold increase has been investigated, before and after spinal manipulation and joint play procedures, by measuring tolerance to electrically induced pain (Terrett and Vernon, 1984). Increases in pain tolerance were measured in two groups. Those who received spinal manipulation, as opposed to mobilization, had a significantly higher increase in their tolerance to pain. To further investigate the mechanisms underlying this phenomenon, Vernon et al. (1986) analyzed serum beta-endorphin levels before and after spinal manipulation in a population of normal male subjects. They detected significant increases in circulating endorphin levels in the experimental group at 5 minutes post-manipulation.

Similar results, however, were not reported in later studies (Christian et al., 1988; Sanders et al., 1990). Experiments involving laboratory animals have been scarce, and no definitive anatomic or biomechanical models are available in the chiropractic literature to support the theories and mechanisms of action associated with spinal manipulation (Brennan et al., 1997). There is scientific evidence, however, suggesting the efficacy of manipulation in increasing joint mobility (Lewit, 1985; Mierau et al., 1988), reducing segmental muscular hypotonicity (Buerger, 1983; Grice, 1974; Korr, 1975; Shambaugh, 1987), and relieving spinal pain and tenderness (Gillette, 1995; Patterson and Steinmetz, 1986). As well, treatment for visceral conditions (Leach, 1994) and systemic disorders (Crawford et al., 1986) through manipulation is gaining acceptance, due to its possible influence on the autonomic nervous system (Cauwenbergs, 1995). Nevertheless, much more systematic research is needed to establish a firm scientific basis for chiropractic treatment, particularly for its efficacy in addressing exercise-induced muscle damage.

Summary and Conclusions

It is possible that manipulation may mechanically alter tissues, induce a series of neurophysiologic effects, and produce outcomes directly associated with a variety of psychological influences (Gross et al., 1996). Manipulative therapy may be beneficial in reducing joint fixation or hypomobility, according to a number of proposed mechanisms including: (a) freeing of entrapped meniscoid or discal elements (Bogduk and Engel, 1984; Lewit, 1985) noted to be heavily innervated by nociceptors (Bogduk and Jull, 1985; Giles and Harvey, 1987; Giles and Taylor, 1987), thus reducing pain; (b) stretching to alter morphological and biochemical changes induced in muscle spindles and muscular tissues that have been subjected to effects of immobilization (Lantz, 1995); and (c) mechanical disruption of intra-articular adhesions known to accumulate as the result of joint immobility (Enneking and Horowitz, 1972).

Interest in the profession of chiropractic is growing. Interest in manipulation and its clinical effectiveness in relieving painful conditions associated with the musculoskeletal system is increasing as well, and having an impact on a variety of specialties within the health care profession. Once considered a less than therapeutic system surrounded by skepticism, there is now a growing body of evidence supporting the efficacy of chiropractic practice, justifying its inclusion into the mainstream, as a useful and beneficial adjunct in many aspects of the accepted health care model (Chapman-Smith, 1997a).

Hippocrates suggested that the degenerative elements of the spine may, in some capacity, contribute to the etiology of many pathological conditions. Such degenerative change may result in spinal nerve root irritation and lead to the development of abnormal nerve function. Mennell (1964), an early proponent of joint play and manipulation, suggested that pathological joint dysfunction responds favorably to treatment by manipulation. Current research tends to indicate that chiropractic intervention via manipulative therapy does provide some relief from pain and may hasten the recovery period for those suffering from low back pain and neck pain. Long-term benefits of manipulative therapy have yet to be demonstrated. It is generally accepted, however, that manipulation does improve ranges of joint motion and may increase pain threshold, possibly through the release of

endogenous analgesics such as beta-endorphins. Manipulation may also theoretically affect muscle relaxation mechanisms.

Although the scientific evidence associated with chiropractic intervention in the treatment of musculoskeletal conditions continues to mount, there is much to learn. The precise mechanisms underlying the patient-perceived benefit currently elude our grasp and must be clearly elucidated. Through appropriate, well-directed research and clinical reporting, it is anticipated that further understanding in manipulative therapeutic techniques will serve to benefit chiropractic clinicians, those they serve, and the health care system in general. And, in the words of Wardell (1992), "It also seems certain that chiropractic will not simply fade away, considering its currently entrenched legal status, its solid acceptance by the public and its developing collegial relations with MDs" (p. 286).

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The 1997 Nagano Symposium on Sports Sciences

H. Nose, E.R. Nadel, and T. Morimoto (Eds.). Published 1998 by Cooper Publications, Carmel, IN (646 pp., hard cover, $75 U.S.)

Reviewed by Roy J. Shephard

This book offers a collection of 85 papers presented at the Scientific Symposium which preceded the Nagano Winter Olympics. In contrast to the scientific meetings associated with many of the Olympic Games, almost all of the papers are firmly centered in exercise physiology, and quite a number deal with animal rather than human experimentation. Indeed, the general feel of the volume is rather similar to the "Perspectives in Exercise Science" series from the same publisher. This similarity is heightened by a cameo submission from Robert Murray, of the Gatorade Exercise Physiology Laboratory, in the section on Sports Nutrition. However, there are fewer authoritative keynote presentations, the audience discussion of the papers is not recorded, and the reference lists are shorter (10–20 per paper) than in the Gatorade symposia.

The book has 15 sections in all; the 3 most extensive parts cover respiration and circulation, muscle blood flow and metabolism, and hypobaric and hypoxic stress. Other topics include hyperbaric and thermal stress, body fluids, nutrition, training, aging, immunity, sports injury, rehabilitation, methodology, and spectator medicine. In many of these sections the lead paper is by a familiar figure from the international lecture circuit, and often the comments of these participants are relatively predictable. More interesting are the remaining papers in the various sections, mainly contributed by Japanese authors. These latter chapters are mostly of good quality and written in remarkably clear English. Their content also reflects the sophistication of the experimental equipment now available to many Japanese exercise physiology laboratories; among the technologies that were exploited, I noted NMR, near infra-red spectroscopy, and 3D positron emission tomography.

There is obviously far from unanimity of opinion among Japanese exercise physiologists on quite a number of topics. For instance, in the section on hyperbaric environments, one paper reported no decrease in physical performance, whereas another paper in the same section found a decrease in performance at what seems to have been essentially the same work rate. One curiosity was a chapter on the merits of Ginseng and similar botanical products, but, paradoxically, this was presented by representatives of the Amway Corporation rather than by Oriental experts. Fortunately, Gatorade and Amway appear to have been the only two contributors who were trying to sell something at this symposium!

The brief sections on medical problems provided what was, for me, some of the most interesting material. A case is described in which altitude exposure seemingly exacerbated hypertension enough to cause a cerebral haemorrhage, 3 papers discuss the high incidence of head injuries in snow-boarding, and an estimate is offered of the likely number of incidents of cardiac arrest in spectators at mass sporting events (5 per million).