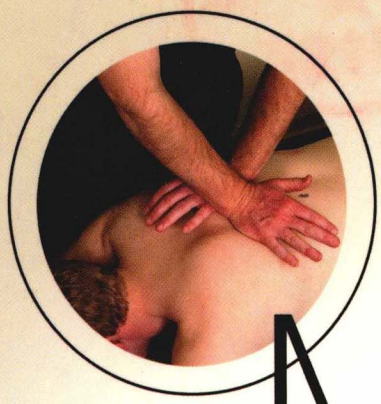
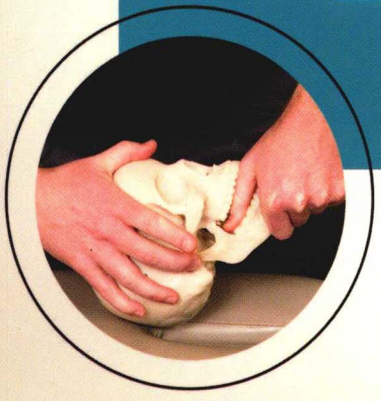
Kenneth A. Olson



MANUAL PHYSICAL THERAPY OF THE SPINE



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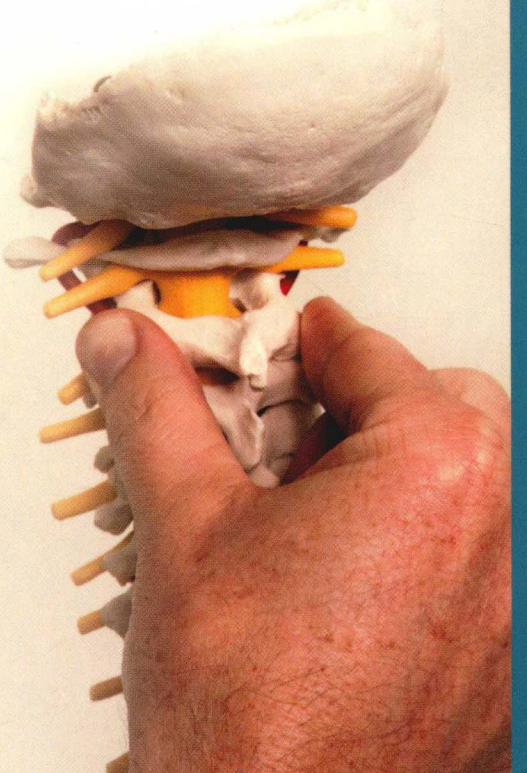

ELSEVIER

MANUAL PHYSICAL THERAPY OF THE SPINE

2nd Edition

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MANUAL PHYSICAL THERAPY OF THE SPINE

2nd Edition

To my wife, Janet, and children, Will and Emma,
for their love and support, and for bringing joy to my life

To my parents, John and Anna Mae, for providing a solid foundation to grow and learn

To my grandmother, Miriam, for instilling a passion for helping and teaching

Foreword From the First Edition

Dr. Ken Olson's textbook, *Manual Physical Therapy of the Spine,* is a welcome addition to the manual therapy literature. Ken's strong clinical and academic backgrounds provide him with the requisite perspective to write a textbook that is both relevant and practical. Writing a textbook with a broad target audience in mind – physical therapist practitioners, residents and students, physicians, and other manual therapy practitioners – can be very challenging, but I believe Ken has easily met this challenge.

Chapters 1 through 3 are of primary interest to the physical therapy community. Understanding the history of and theories behind manual therapy – thrust joint manipulation in particular – is essential for the appropriate use of such techniques. The history of spinal manipulation clearly provides evidence supporting the claim that no single "modern" health care profession invented or owns this intervention. What makes the various invested professions unique are the underlying rationale and terminology associated with their use of these procedures.

Chapters 4 through 7 provide a fantastic array of examination and treatment techniques that are of interest to all manual therapy practitioners. The illustrations are clear and easy to follow. Learning a technique through drawings and photographs is not easy, but the superb figures in this textbook allow a novice practitioner to begin appreciating the nuances of therapist hand placement, applied direction of force, and patient positioning, thus facilitating student and practitioner skill development and confidence. Video clips further facilitate instruction and learning of the manual examination and manipulation techniques. A great asset to students and clinicians, the video clips highlight patient and therapist position and force application throughout each demonstration.

The textbook provides a thorough theoretical grounding from the perspective of a physical therapist, making it essential background information for physical therapist students, residents, and fellows. The material is also of value to practitioners outside the physical therapy profession, because it promotes better understanding of where we as professions overlap and where we diverge. Dr. Olson's thorough literature review promotes an evidence-based approach to utilization of manual therapy techniques. If this approach is adopted by all interested parties, then similarities between the various professions should increase and the differences over time should disappear.

Manual Physical Therapy of the Spine provides readers with the perfect blend between theory and practice. The textbook is a rich teaching resource for physical therapist academic faculty and residency/fellowship instructors. For students, residents, and fellows, the textbook is invaluable not only during their educational experience but also beyond. Dr. Olson is to be commended and applauded for his efforts to provide us with a textbook that is relevant to today's practice and will remain so far into the future.

William G. Boissonnault PT, DHSc, FAAOMPT

Preface

The second edition of this textbook has maintained the format and organization established in the first edition but has updated and expanded the research evidence presented to support an impairment-based manual physical therapy approach to evaluate and treat spinal and temporomandibular conditions. The impairment-based classifications used to guide the treatment of lumbar and cervical spine conditions have also incorporated the Low Back Pain and Neck Pain Clinical Practice Guidelines Linked to the International Classification of Functioning, Disability, and Health from the Orthopaedic Section of the American Physical Therapy Association.

Nearly 120 video clips have been added to the more than 80 original video clips so that the vast majority of examination and manual therapy treatment procedures are presented both in the textbook and via video. The video clips will be available through a web-based format rather than a DVD so that the electronic version of the textbook will have access to the video clips. The video clips were filmed at Marquette University with the technical support of the Marquette University Instructional Media Center, where multiple camera angles are used to assure excellent visualization of each procedure.

Each chapter has areas that have been updated and expanded. The primary addition of Chapter 1 involves expanded explanation on the history of manipulation within the physical therapy profession and an enhanced discussion on the principles of expert clinical decision-making. Chapter 2 includes updates and additions on the evidence for diagnostic accuracy of examination and neurological screening procedures. Chapter 2 also includes a new section on myofascial pain and trigger points. Chapter 3 includes an expanded and updated explanation of the effects of manipulation based on new evidence of the mechanical, neurophysiological, and psychological effects of manipulation. The Chapter 3 section on the safety of manipulation now incorporates components of the *International framework for examination of the cervical region for potential of cervical arterial dysfunction prior to orthopaedic manual physical therapy intervention,* a consensus document produced by the International Federation of Orthopaedic Manipulative Physical Therapist.

Chapters 4 through 7 have maintained the same formatting structure for each region of the spine and the TMJ, with updates and expansion on the diagnostic accuracy information and evidence to support the therapeutic exercise and manipulation interventions in each region. Chapter 4 has also expanded on the examination procedures of the hip and provided new illustrations of variations of lumbar and pelvic examination and manipulation procedures. Additional information on use of psychologically informed management strategies for chronic low back pain have been added to this chapter. Chapter 5 has a new section on examination, classification, and treatment of thoracic outlet syndrome in addition to the updates on the evidence to support the use of thoracic manipulation. Chapter 6 has a new section on cervicogenic dizziness, in addition to updates on the evidence to support manipulation and therapeutic exercise for the management of cervical spinal conditions. There are also additional exercises and explanation of cervical spine muscle function added to this chapter to enhance the treatment of movement coordination impairments of the cervical spine. Chapter 7 includes enhanced information on differentiation of headache types and examination/classification and treatment of temporomandibular disorders.

This textbook provides the necessary background information and detailed instructional materials to allow full integration of manipulation and manual physical therapy examination and treatment procedures of the spine and TMJ into physical therapist professional education and clinical practice. This textbook combined with the video clips provides the necessary background and instructional information to assist in skill development to effectively implement contemporary evidence-based treatment recommendations related to manual therapy, manipulation, and therapeutic exercise.

The primary audience for this textbook is physical therapy students and faculty in professional physical therapist education programs. The secondary audience for this textbook is practicing physical therapists and other clinicians who wish to keep up with what is being taught in professional physical therapist education programs. Additionally, persons in manual physical therapy residency, fellowship, and post-professional degree programs in orthopaedic and manual physical therapy will find this textbook to be a useful adjunct to other instructional materials.

The textbook and video clips will be very useful additions to the permanent library of clinicians who practice manual therapy techniques to manage spinal disorders. Although the body of research evidence will continue to evolve over time, the technique descriptions and presentations will remain as valuable resources to reference when practitioners are presented with various spinal and TMJ disorders in the future.

Kenneth A. Olson

Acknowledgments

Professionally I am indebted to the influence and mentorship of Stanley Paris and the faculty and staff of the University of St. Augustine for Health Sciences, who guided my graduate education. Other professional mentors include Bill Boissonnault, Tim Dunlop, Laurie Hartman, Mary Jane Harris, Trish King, David Lamb, Steve McDavitt, Catherine Patla, Mariano Rocabodo, and Guy Simoneau. I am grateful to Jason Beneciuk, Josh Cleland, Elaine Lonnemann, Louie Puentedura, Ron Schenk, and Guy Simoneau for reviewing chapters of the first and second editions of this textbook and providing useful feedback to improve the quality of the project. I also acknowledge my colleagues in private practice, especially physical therapists Aaron Nevdal and Todd Vanatta, and my current and past students who have contributed in my journey and challenged me to find better ways to teach and practice manual physical therapy.

Kathy Falk, Brian Loehr, and Brandi Flagg at Elsevier have been helpful and efficient in helping to move this book along in a timely manner. Jim Womack took the photographs used in the textbook and the video clips were filmed in a professional manner by the Marquette University Instructional Media Center.

Kenneth A. Olson

Contents

CHAPTER 1

Introduction

OVERVIEW

This chapter introduces the purpose of the textbook, describes the history of manipulation, defines common terminology used in the textbook, introduces evidence-based principles, and provides an explanation for use of the textbook and the accompanying video clips.

OBJECTIVES

- Describe the purpose of the textbook.
- Explain the philosophy of treatment used in orthopaedic manual physical therapy.
- Describe the history of manipulation.
- Define common terminology used in orthopaedic manual physical therapy.
- Explain evidence-based principles for assessment of the reliability and validity of clinical examination procedures and clinical trials.
- Explain how to use this textbook and video clips.

PURPOSE

The purpose of this textbook is to provide the necessary background information and detailed instructional materials to allow full integration of manipulation and manual physical therapy examination and treatment procedures of the spine into physical therapist professional education and clinical practice.

Physical therapy students and faculty in professional physical therapist education programs are the primary audience for this textbook. The secondary audience includes practicing physical therapists, chiropractors, and osteopathic physicians who want to keep current with professional physical therapist education programs. In addition, this textbook is a useful adjunct to other instructional materials for manual physical therapy residency, fellowship, and postprofessional degree programs in orthopaedic and manual physical therapy.

Physical therapists have been practicing manipulation since the inception of the profession, and all physical therapist professional degree programs must demonstrate full integration of both thrust and nonthrust joint manipulation in the curriculum to maintain accreditation.[1,2] The intent of this textbook is to provide physical therapist programs detailed instructional materials for the most effective instruction of manipulation.

Prerequisites in the curriculum should include clinical tests and measures for musculoskeletal conditions, including manual muscle testing, muscle length testing, and goniometry. Knowledge of therapeutic exercise, anatomy, physiology, and functional anatomy and biomechanics should also precede instruction in manipulation. Each chapter provides a review of the evidence to support the examination and treatment techniques presented in the chapter and the kinematics and functional anatomy of the anatomic areas covered in the chapter. An impairment-based classification of common conditions treated by physical therapists is presented in each chapter to assist with clinical decision making, and patient management principles are addressed for each condition. Detailed descriptions of examination and manual therapy treatment procedures are covered in each chapter and in the video clips. Common exercises to address each diagnostic classification are also included in each chapter.

HISTORY OF MANIPULATION

Manipulation in recorded history can be traced to the days of Hippocrates, the father of medicine (460–370 BC). Evidence is seen in ancient writings that Hippocrates used spinal traction methods. In the paper "On Setting Joints by Leverage," Hippocrates describes the techniques used to manipulate a dislocated shoulder of a wrestler.[3] Succussion was also practiced in the days of Hippocrates. The patient was strapped in an inverted position to a rack that was attached to ropes and pulleys along the side of a building. The ropes were pulled to elevate the patient and the rack as much as 75 feet, at which time the ropes were released and the patient crashed to the ground to receive a distractive thrust as the rack hit the ground[4] (Figure 1-1). Six hundred years later, Galen (130–200 AD) wrote extensively on exercise and manipulation procedures in medicine.[3]

Hippocrates' methods continued to be used throughout the Middle Ages, with little advance in the practice of medicine and manipulation because of the reliance on the church for most healing throughout Europe.[3] In the Renaissance era, Ambroise Paré (1510–1590) emerged as a famous French physician and surgeon[3] who used armor to stabilize the spine in patients with tuberculosis[4] (Figure 1-2). His manipulation and traction techniques were similar to those of Hippocrates, but he opposed the use of succussion.[4]

The bonesetters flourished in Europe from the 1600s through the late 1800s. In 1656, Friar Moulton published *The Complete Bone-Setter.* The book was later revised by Robert Turner.[4] No formal training was required for bonesetters; the techniques were often learned from family members and passed down from one generation to the next. The clicking sounds that occurred with manipulation were thought to be the result of bones moving back into place.[4]

In 1871, Wharton Hood published *On Bone-Setting,* the first such book by an orthodox medical practitioner.[5] Hood learned about bonesetting after his father had treated a bonesetter, Richard Hutton. Hutton was grateful for the medical care and offered to teach his practitioner about bonesetting. Instead, it was the practitioner's son, Wharton Hood, who accepted the offer. Hood thought that the snapping sound with manipulation was the result of breaking joint adhesions.[5] Paget[6] believed that orthodox medicine should consider the adoption of what was good and useful about bonesetting but should avoid what was potentially dangerous and useless.

Osteopathy was founded by Andrew Still (1826–1917) in 1874. In 1896, the first school of osteopathy was formed in Kirksville, Missouri.[4] Still developed osteopathy based on the "rule of the artery," with the premise that the body has an innate ability to heal and that with spinal manipulation to correct the structural alignment of the spine, the blood can flow to various regions of the body to restore the body's homeostasis and natural healing abilities. Still's philosophy placed an emphasis on the relationship of structure to function and used manipulation to improve the spinal structure to promote optimal health.[7] The osteopathic profession continues to include manipulation in the course curriculum but does not adhere to Still's original treatment philosophy. Many osteopathic physicians in the United States do not practice manipulation regularly because they are focused on other specialty areas, such as internal medicine or emergency medicine. Osteopathy in many European countries remains primarily a manual therapy profession.

Chiropractic was founded in 1895 by Daniel David Palmer (1845–1913). One of the first graduates of the Palmer School of Chiropractic in Davenport, Iowa, was Palmer's son Bartlett Joshua Palmer (1882–1961), who later ran the school and

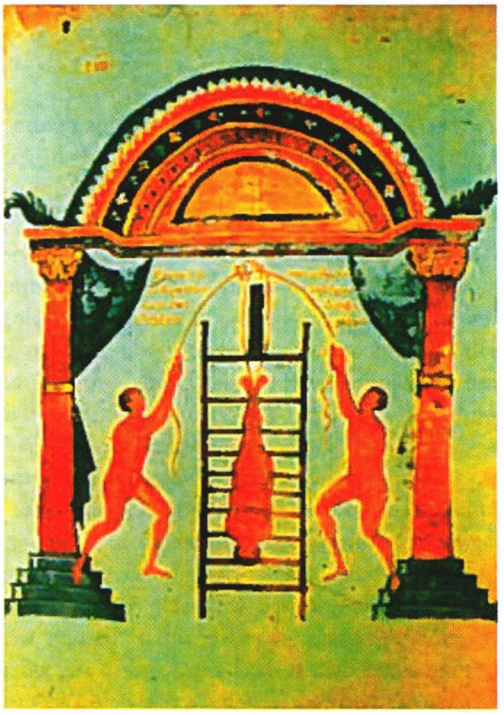

FIGURE 1-1 Falling ladder (a.k.a. succession). (From Schoitz.)

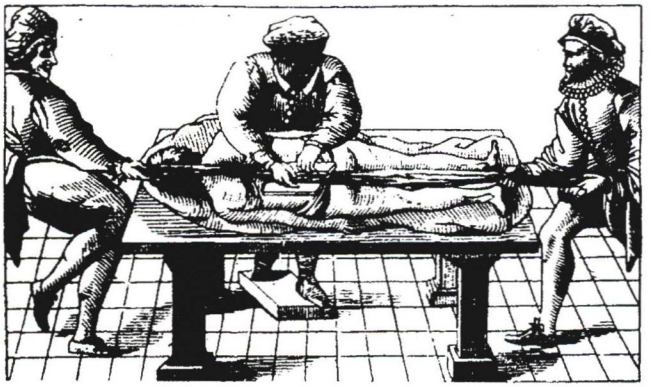

FIGURE 1-2 Ambroise Paré applied manual therapy to the spine in conjunction with spinal traction, similar to Hippocrates' methods described over 1000 years earlier. (From Paré, Ambroise. Opera. Liber XV, Cap. XVI, pp. 440-441, Paris, 1582.)

promoted the growth of the profession. D. D. Palmer was a storekeeper and a "magnetic healer." According to legend, in 1895 he used a manual adjustment directed to the fourth thoracic vertebra that resulted in the restoration of a man's hearing.[8] The original chiropractic philosophy is based on the "law of the nerve," which states that adjustment of a subluxed vertebra removes impingement on the nerve and restores innervation and promotes healing of disease processes.[3] The "straight" chiropractors continue to adhere to Palmer's original subluxation theories and use spinal adjustments as the primary means of treatment. The "mixers" incorporate other rehabilitative interventions into the treatment options, including physical modalities, such as therapeutic ultrasound and exercise.

The origins of physical therapy can be traced to the Royal Central Institute of Gymnastics (RCIG), founded in 1813 by Pehr Henrik Ling (1776–1839) in Stockholm, Sweden[9,10] (Figure 1-3). Ling's educational system included four branches: pedagogical gymnastics (physical education), military gymnastics (mostly fencing), medical gymnastics (physical therapy), and esthetic gymnastics (philosophy). Ling systematized medical gymnastics into two divisions, massage and exercise, with massage defined as movements done on the body and exercise being movements done with a part of the body.[11,12] Ling may not have been the originator of medical gymnastics or massage, but he systematized these methods and attempted to add contemporary knowledge of anatomy and physiology to support medical gymnastics.[11,12]

Graduates of the RCIG earned the title "director of gymnastics" and in 1887 were licensed by Sweden's National Board of Health and Welfare, where physical therapists continue to use the title *sjukgymnast* ("gymnast for the sick").[9,13] Throughout the nineteenth century, the RCIG provided its graduates with a scientific rationale, based on contemporary knowledge of anatomy and physiology, for the benefits of combining specific active, resistive, and passive movements and exercises, including variations of spinal manipulation, traction, and massage.[9] "Ling's doctrine of harmony" purported that the health of the body depended on the balance between three primary forms: mechanics (movement/exercise/manipulation), chemistry (food/medicine), and dynamics (psychiatry), and the Ling physical therapists were trained to restore this harmony through use of manual therapy.

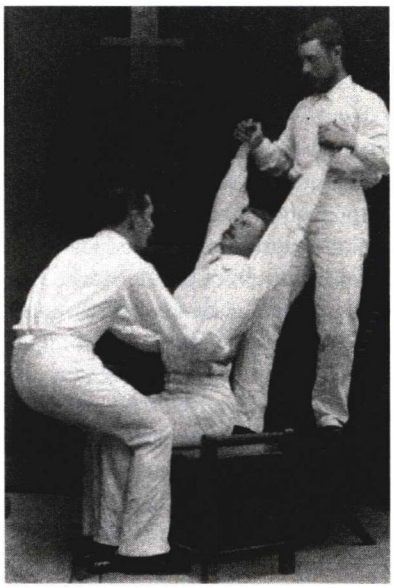

FIGURE 1-3 Thoracic traction as performed by graduates of the Royal Central Institute of Gymnastics in the mid-1800s. (Reproduced with permission from Dr. Ottosson, http://www.chronomedica.se.)

Graduates of RCIG immigrated to almost every major European city, Russia, and North America through the mid to late 1800s to establish centers of medical gymnastics and mechanical treatments.[9] Jonas Henrik Kellgren (1837–1916) graduated from the RCIG in 1865, eventually opened clinics in Sweden, Germany, France, and London, and is credited with development of many specific spinal and nerve manipulation techniques.[9] In addition, medical doctors from throughout Europe enrolled in the RCIG to add physical therapy methods to their treatment of human ailments and attained joint credentials as physician/physical therapist. Edgar F. Cyriax (1874–1955), the son-in-law of Kellgren and a graduate of RCIG before becoming a medical doctor, published more than 50 articles on Ling's and Kellgren's methods of physical therapy in international journals and advocated to include "mechano-therapeutics" in the curriculum and training of medical doctors in Britain.[9] In 1899, the Chartered Society of Physiotherapy was founded in England.[3] The first professional physical therapy association in the United States, which was the forerunner to the American Physical Therapy Association (APTA), was formed in 1921.[1]

Between 1921 and 1936, at least 21 articles and book reviews on manipulation were found in the physical therapy literature,[14] including the 1921 textbook, *Massage and Therapeutic Exercise,* by the founder and first president of the APTA, Mary McMillan. McMillan credits Ling and his followers with development and refinement of the methods used to form the physical therapy profession in the United States.[11,12] In fact, McMillan devotes a 15-page chapter of her book to specific therapeutic exercise regimes developed by Ling referred to as "A Day's Order" and states that the term *medical gymnastics* is synonymous with *therapeutic exercise.* In a subsequent editorial,[11] she wrote of the four branches of physiotherapy, which she identified as "manipulation of muscle and joints, therapeutic exercise, electrotherapy, and hydrotherapy."[12] Titles of articles during this period were quite explicit regarding manipulation, such as "The Art of Mobilizing Joints"[15] and "Manipulative Treatment of Lumbosacral Derangement."[16] The articles used phrases such as "adhesion . . . stretched or torn by this simple manipulation"[17] and "manipulation of the spine and sacroiliac joint."[18] This usage helps illustrate that manipulation has been part of physical therapy practice since the founding of the profession and through the 1930s.[14]

From 1940 to the mid-1970s, the word *manipulation* was not widely used in the American physical therapy literature.[3] This omission may have been due in part to the American

Medical Association's Committee on Quackery, which was formed in the 1960s and was active for the next 30 years in an attempt to discredit the chiropractic profession. The committee was forced to dissolve in 1990 because of Wilk's "restraint of trade" case, which was upheld in the US Supreme Court.[8] Because physical therapy remained within the mainstream medical model, the terms *mobilization* and *articulation* were used during this timeframe to separate physical therapy from chiropractic. However, physical therapists continued to practice various forms of manipulation.

Through the early to mid 1900s, several prominent European orthopaedic physicians influenced the practice of manipulation and the evolution of the physical therapist's role as a manipulative therapist. Between 1912 and 1935, James Mennell (1880–1957) provided advanced training in manipulation technique for physiotherapist at St. Thomas's Hospital in London.[19] In 1949, James Mennell published his textbook titled the *Science and Art of Joint Manipulation.* Mennell adapted knowledge of joint mechanics in the practice of manipulation and coined the phrase "accessory motion."[20] James H. Cyriax (1904–1985), son of Edgar Cyriax and grandson of Jonas Henrik Kellgren, published his classic *Textbook of Orthopaedic Medicine* in 1954. He made great contributions to orthopaedic medicine with the development of detailed systematic examination procedures for extremity disorders, including refinement of isometric tissue tension signs, end feel assessment, and capsular patterns.[21] Cyriax attributed most back pain to disorders of the intervertebral disc and used aggressive general manipulation techniques that included strong manual traction forces to "reduce the disc."[21] Cyriax, who also taught and practiced orthopaedic medicine at St. Thomas's Hospital until 1969 and was the successor of Mennell at St Thomas's,[22] influenced many physiotherapists, including Stanley Paris and Freddy Kaltenborn, to carry on the skills and techniques required to effectively use manipulation.

Alan Stoddard[7] (1915–2002) was a medical and osteopathic physician in England who used skillful specific manipulation technique and also mentored many physical therapists, including Paris and Kaltenborn (Figure 1-4). Stoddard authored two textbooks, *Manual of Osteopathic Technique* (1959) and *Manual of Osteopathic Practice* (1969), which became the cornerstone of osteopathic teaching in schools around the world.[23] Physical therapists, Kaltenborn[24] and Paris,[25] both believed that the Cyriax approach to extremity conditions was excellent, but they preferred Stoddard's specific manipulation techniques for the spine.

John Mennell (1916–1992), the son of James Mennell, first practiced orthopaedic medicine in England. In the 1960s, he immigrated to the United States, where he held many educational programs for physical therapists through the 1970s and 1980s to promote manipulation within the physical therapy profession. He published several textbooks, including *Joint Pain, Foot Pain,* and *Back Pain* and coined the phrase "joint play."[27] Mennell brought attention to sources of back pain other than the intervertebral disc.

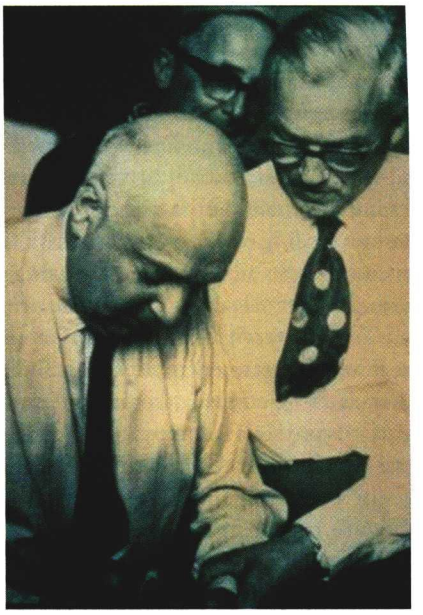

FIGURE 1-4 Cyriax *(left)* and Stoddard *(right)* in Norway, 1965. (From Kaltenborn FM: *Manual mobilization of the joints: volume II: The spine,* Oslo, Norway, 2012, Norli.)

In the 1960s, several physical therapists emerged as international leaders in the practice and instruction of manipulation. Physical therapist Freddy Kaltenborn, originally from Norway, developed what is now known as the Nordic approach. He published his first textbook on spinal manipulation in 1964 and was the first to relate manipulation to arthrokinematics.[25] His techniques were specific and perpetuated the importance of biomechanical principles, such as the concave/convex and arthrokinematic rules. Kaltenborn, in collaboration with physical therapist Olaf Evjenth, also developed extensive long-term training programs for physical therapists to specialize in manual therapy first in Norway and later throughout Europe, North America, and Asia.

Australian physical therapist, Geoffrey Maitland (1924–2010), published the first edition of his book *Vertebral Manipulation* in 1964.[28] Maitland was also influenced by the work of Cyriax and Stoddard but further refined the importance of a detailed history and comprehensive physical examination. He also developed the concept of treatment of "reproducible signs" and inhibition of joint pain with use of gentle oscillatory manipulation techniques. Maitland developed the I to IV grading system to further describe oscillatory manipulation techniques.[28] Maitland also established long-term manual therapy educational programs affiliated with universities in Australia, which subsequently facilitated the rapid growth of musculoskeletal physical therapy research.

Physical therapist, Stanley Paris, was originally from New Zealand. Early in his career, in 1961 and 1962, he was awarded a scholarship to study manipulation in Europe and the United States.[14] He had the opportunity to study with Cyriax, Stoddard, and Kaltenborn during this time and in 1965 published the textbook *Spinal Lesion.*[26] In the late

FIGURE 1-5 Photograph was taken in 1974 in Montreal, Canada, at the successful formation of the International Federation of Orthopaedic Manipulative Physical Therapists (IFOMPT). Dr. Paris was Chair of the conference. The other three individuals were consultants to the process and had served in that capacity for 6 years before this event. IFOMPT later became a subsection of the World Confederation for Physical Therapy (WCPT). From left: Geoffrey Maitland, Stanley Paris, Freddy Kaltenborn, and Gregory Grieve. (From Paris SV: 37th Mary McMillan lecture: in the best interest of the patient, *Phys Ther* 86[11]:1541-1553, 2006.)

1960s, Paris immigrated to the United States, where he eventually completed his doctoral work in neuroanatomy of the lumbar spine and developed extensive educational programs for postprofessional physical therapy education in manual physical therapy and manipulation that eventually resulted in the formation the University of St. Augustine for Health Sciences in St. Augustine, Florida. Paris also played key roles in formation of professional organizations in the United States, including the APTA Orthopaedic Section and the American Academy of Orthopaedic Manual Physical Therapists (AAOMPT), two professional organizations that have played roles in advocating for inclusion of manipulation within the scope of physical therapy practice and that have promoted education, practice, and research in manual physical therapy. Paris worked with physical therapists Maitland, Kaltenborn, and Gregory Grieve of the United Kingdom to form the International Federation of Orthopaedic Manipulative Physical Therapists (IFOMPT; Figure 1-5).

The IFOMPT was founded in 1974 and represents organized groups of manual/manipulative physical therapists around the world that have established stringent postgraduation specialization educational programs in manual/manipulative physical therapy. The federation sets educational and clinical standards and is a subgroup of the World Confederation of Physical Therapy (WCPT). One organization of each WCPT country can be recognized by IFOMPT to represent that country if the organization meets IFOMPT criteria. The IFOMPT educational standards and international monitoring system has allowed physical therapists to be recognized as orthopaedic manual physical therapy (OMPT) specialists in countries beyond the country where they received their training.

The Orthopaedic Section of the APTA represents all aspects of musculoskeletal physical therapy and is open to all members of the APTA, including physical therapist assistants. Before formation of the AAOMPT, no organization in the United States could meet the IFOMPT criteria because no recognized educational system in manual therapy upheld standards of training and examination in manual therapy for physical therapists in the United States. However, by 1990 at least eight active manual therapy fellowship programs were operating independently within the United States.

In 1991, Freddy Kaltenborn invited representatives from these eight manual therapy fellowship programs to meet at Oakland University in Michigan to consider how the United States could develop educational standards in manual therapy and become a member organization of IFOMPT.[29] These eight physical therapists, Stanley Paris, Mike Rogers, Michael Moore, Kornelia Kulig, Bjorn Swensen, Dick Erhard, Joe Farrell, and Ola Grimsby, became the founding members of the AAOMPT. The AAOMPT developed a standards document, bylaws, and a recognition process for manual therapy fellowship programs. In 1992, the AAOMPT was accepted as the member organization to represent the United States in IFOMPT.

Although prominent individuals, such as Paris, Kaltenborn, and Maitland, played a large role in development and advancement of manipulation and manual therapy within the physical therapy profession over the last half of the twentieth century, the current practice and the future of the specialty area of OMPT are driven by evidence-based practice and the promotion of OMPT practice through professional associations, such as IFOMPT, AAOMPT, and the APTA.[29] A large and growing body of research evidence supports and guides the practice of manipulation within the scope of physical therapy practice and for other manual therapy practitioners.

ORTHOPAEDIC MANUAL PHYSICAL THERAPY TREATMENT PHILOSOPHY

IFOMPT defines OMPT as a specialized area of physiotherapy/physical therapy for the management of neuro-musculo-skeletal conditions, based on clinical reasoning, using highly specific treatment approaches including manual techniques and therapeutic exercises. OMPT also encompasses, and is driven by, the available scientific and clinical evidence and the biopsychosocial framework of each individual patient (see the IFOMPT Constitution 2012 at http://www.ifompt.com/site/ifompt/files/pdf//IFOMPT_Constitution.pdf).

IFOMPT considers the following terms as being interchangeable: *orthopaedic manual_therapy, orthopaedic manual physical therapy, orthopaedic manipulative therapy,* and *orthopaedic manipulative physical therapy* (per IFOMPT Constitution 2012).

Paris[30] described a nine-point "Philosophy of Dysfunction" that summarizes the components of a traditional OMPT

BOX 1-1 Philosophy of Dysfunction as Described by Paris

I. That joint injury, including such conditions referred to as osteoarthritis, instability, and the after effects of sprains and strains, are dysfunctions rather than diseases.
II. That dysfunctions are manifest as either increases or decreases of motion from the expected normal or by the presence of aberrant movements. Thus, dysfunctions are represented by abnormal movements.
III. That where the dysfunction is detected as limited motion (hypomobility), the treatment of choice is manipulation to joint structures, stretching to muscles and fascia and the promotion of activities that encourage a full range of movement.
IV. That when the dysfunction is manifest as increased movement (hypermobility), laxity or instability, the treatment of the joint in question is not manipulation but stabilization by instruction of correct posture, stabilization exercises and correction of any limitations of movement in neighboring joints that may be contributing to the hypermobility.
V. That the primary cause of degenerative joint disease is joint dysfunction. Therefore, it may be concluded that its presence is due to the failure or lack of accessibility to physical therapy.
VI. That the physical therapist's primary role is in the evaluation and treatment of dysfunction, whereas that of the physician is the diagnosis and treatment of disease. These are two separate but complementary roles in health care.
VII. That since dysfunction is the cause of pain, the primary goal of physical therapy should be to correct the dysfunction rather than the pain. When, however, the nature of the pain interferes with correcting the dysfunction, the pain will need to be addressed as part of the treatment program.
VIII. That the key to understanding dysfunction, and thus being able to evaluate and treat it, is understanding anatomy and biomechanics. It therefore behooves us in physical therapy to develop our knowledge and skills in these areas so that we may safely assume leadership in the non-operative management of neuromusculoskeletal disorders.
IX. That it is the patients' responsibility to restore, maintain, and enhance their health. In this context, the role of the physical therapist is to serve as an educator, to be an example to the patient, and to reinforce a healthy and productive lifestyle.

Adapted from Paris SV: *Introduction to spinal evaluation and manipulation*, Atlanta, 1986, Institute Press.

treatment philosophy (Box 1-1). Paris defines "dysfunction" as increases or decreases of motion from the expected normal or as the presence of aberrant movements.[4] Therefore, the primary focus of the orthopaedic manual physical therapist's examination is the analysis of active and passive movement. If hypomobility is noted, joint mobilization and stretching techniques are used; if hypermobility is noted, stabilization exercises, motor control, and postural correction are emphasized. If aberrant movements are noted, a motor retraining exercise approach is appropriate. If localization of tissue reactivity and pain are noted, gentle oscillatory techniques as described by Maitland can be used to attempt to inhibit pain.[28] To use *Guide to Physical Therapist Practice* terminology, this is an "impairment-based approach," which is a foundation of physical therapy.

Manual physical therapy approaches place an emphasis on application of biomechanical principles in the examination and treatment of spinal disorders. Motion is analyzed with active and passive motion testing with visualization of the spinal mechanics; the motion is best described with standardized biomechanical terminology. Passive forces are applied, with passive accessory intervertebral motion testing and mobilization/manipulation techniques, along planes of movement parallel or perpendicular to the anatomic planes of the joint surfaces. Therefore, knowledge of spinal anatomy and biomechanics is a prerequisite to learning a manual physical therapy approach for examination and treatment of the spine.

Orthopaedic manual physical therapists use a process of clinical reasoning that includes continual assessment of the patient, followed by application of a trail of manual therapy treatment or exercise, followed by further assessment of the patient's response to the treatment. This intimate relationship between examination, treatment, and reexamination provides useful clinical data for sound judgments regarding the patient's response to treatment and the need to modify, progress, or maintain the applied interventions. Use of examination procedures with proven reliability and validity further enhances the clinical decision-making process.

Physical therapists have embraced the principles of evidence-based practice. When research evidence is available to guide clinical decisions, the physical therapist should follow the evidence-based practice guidelines. However, when research evidence is not clear, an impairment-based approach that includes a thorough evaluation and sound clinical decision making should be used, with a focus on restoring function, reducing pain, and returning the patient to functional activities. In fact, a growing body of research evidence demonstrates the effectiveness of an impairment-based orthopaedic manual physical therapy approach for the treatment of spine and extremity musculoskeletal conditions.[31–39] This textbook attempts to incorporate the best available evidence with an orthopaedic manual physical therapy approach.

The evidence supports use of a classification system to guide the treatment of patients with spinal disorders.[40-41] An impairment-based classification system that is linked to the International Classification of Functioning, Disability, and Health (ICF) has been developed by the Orthopaedic Section of the APTA for low back and neck pain conditions.[42-43] The ICF impairment-based terminology is incorporated within this textbook where appropriate. The impairment-based classification system recognizes that patients with spinal disorders are a heterogeneous group. However, subgroups of patients can be identified with common signs and symptoms that respond to interventions that can be provided by physical therapists, including manipulation, specific directional exercises, stabilization/neuromuscular control exercises, and traction. A classification of common disorders is described in great detail for each anatomic region covered in this textbook.

So, for effective treatment of patients with spinal disorders, physical therapists complete a comprehensive physical examination that includes screening for red flags to ensure that physical therapy is appropriate to the patient's condition. The examination includes procedures with proven reliability and validity, and the results of the examination are correlated with patient questionnaire information and the patient's history to determine a diagnosis. The diagnosis places the patient in a classification and includes a problem list of noted impairments that affect the patient's condition. As treatment is implemented, the patient's condition is continually reassessed to determine the results of treatment and to determine whether modifications in diagnosis and treatment are necessary. The primary emphasis of the treatment is integration of manual therapy techniques and therapeutic exercise with principles of patient education to ultimately allow the patient to self-manage the condition.

Evidence-Based Practice

Evidence-based practice is defined as the integration of best research evidence with clinical expertise and patient values.[44] The research evidence considered in evidence-based practice is meant to be clinically relevant patient-centered research of the accuracy and precision of diagnostic tests, the power of prognostic markers, and the efficacy and safety of therapeutic, rehabilitative, and preventive regimens.[44] Clinical experience, the ability to use clinical skills and past experience, should also be incorporated into evidence-based practice to identify each patient's health state and diagnosis, risks and benefits of potential interventions, and the patient's values and expectations.[44] Patient values include the unique preferences, concerns, and expectations each patient brings to a clinical situation; these values must be integrated into clinical decisions if the therapist is to properly serve the patient.[44]

Evidence-based principles are incorporated throughout this textbook. When studies are identified to illustrate the accuracy and precision of diagnostic tests, this information is reported in the "notes" section of the examination technique description; when clinical outcome studies that use a specific intervention are identified, this information is included as well. The examination and treatment procedures included in this textbook have been chosen based on the research evidence to support their use, on my clinical experience, and on safety considerations. The decision to use the examination and treatment techniques presented in this textbook should be made based on the clinician's knowledge of the evidence, competence in application of the intervention, and clinical experience combined with the patient's values and expectations. Although this textbook can establish a foundation for evidence-based practice for physical therapy management of spinal and temporomandibular disorders, new evidence continues to emerge regarding the best diagnostic and treatment procedures. Therefore, the practitioner's responsibility is to stay abreast of new developments in research findings and to make appropriate changes in practice to reflect these new findings.

TABLE 1-1 Kappa Coefficient Interpretation

KAPPA STATISTIC	STRENGTH OF AGREEMENT
< 0.00	Poor
0.00–0.20	Slight
0.21–0.40	Fair
0.41–0.60	Moderate
0.61–0.80	Substantial
0.81–1.00	Almost perfect

Data from Landis JR, Koch GG: The measurement of observer agreement for categorical data, *Biometrics* 33:159-174, 1977.

Many of the examination tests presented in this textbook have been tested for reliability and validity; this information is reported when available. Reliability is defined as the extent to which a measurement is consistent and free of error.[45] If an examination test is reliable, it is reproducible and dependable to provide consistent responses in a given condition.[45] Validity is the ability of a test to measure what it is intended to measure.[45] Both reliability and validity are essential considerations in determination of what tests and measures to use in the clinical examination of a patient.

Reliability is often reported as both interrater and intrarater reliability. Intrarater or intraexaminer reliability defines the stability or repeatability of data recorded by one individual across two or more trials.[45] Interrater reliability defines the amount of variability between two or more examiners who measure the same group of subjects.[45] For the statistical analysis of interval or ratio data, the intraclass correlation coefficient (ICC) is the preferred statistical index, because it reflects both correlation and agreement and determines the amount of variance between two or more repeated measures.[45,46] For ordinal, nominal, or categorical data, percent agreement can be determined and the kappa coefficient (k) statistic applied, which takes into account the effects of chance on the percent agreement.[46-47] Landis and Koch[48] have established a general guideline for interpretation of kappa scores (Table 1-1). Because the effect of chance is not affected by prevalence, the kappa coefficient can be deflated if the prevalence of a particular outcome of the test or measure is either very high or very low.[44] "Acceptable reliability" must be determined by the clinician who uses the specific test or measure and should be based on which variable is tested, why a particular test is important, and on whom the test is to be used.[49]

Results of validity testing examination procedures are reported as sensitivity (Sens), specificity (Spec), positive likelihood ratio (+LR), and negative likelihood ratio (–LR). Sensitivity is the test's ability to obtain positive test results when the target condition is really present, or a true positive.[45] The 2 × 2 contingency table (Table 1-2) is used to calculate the sensitivity and specificity. "SnNout" is a useful acronym to remember that tests with high sensitivity have few false negative results; therefore, a negative result rules out the condition.[44] Specificity is the