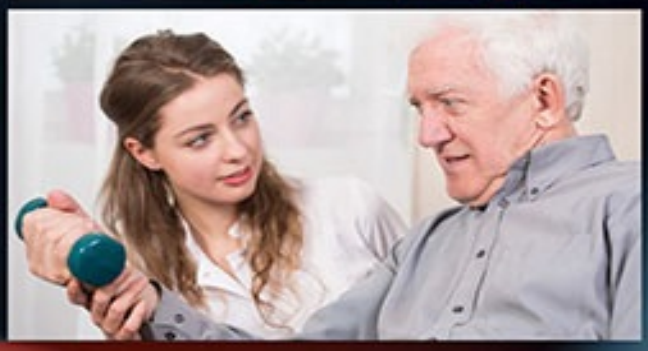
Mechanisms *and* Management *of* Pain *for the* Physical Therapist

SECOND EDITION

Kathleen A. Sluka



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Pain for the Physical Therapist

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Pain for the Physical Therapist

Second Edition

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FOREWORD

Pain has an element of blank;
It cannot recollect
When it began, or if there were
A day when it was not.

It has no future but itself,
Its infinite realms contain
Its past, enlightened to perceive
*New periods of pain.**

It has taken the biomedical community a very long time to begin to understand what Emily Dickinson meant when she wrote about pain in the 1800s. It is clear, however, that Kathleen Sluka and her outstanding assembly of international colleagues get it. I have been involved in teaching neuroscience and electrical modalities to physical therapy students for more than 35 years. The revolution in thinking about pain management during my time as a lecturer parallels the development of more realistic animal models of pain, incredible new techniques to explore the neural mechanisms associated with sustaining the perception of pain, a far greater understanding of personal and environmental factors that influence pain behavior, a broader array of intervention strategies based on a much more rational theoretical framework, and clinically relevant research findings. The breadth of topics in this textbook helps the reader to understand the scope of issues that fit under the umbrella of pain. After reading this text, the reader should be aware that pain, in many instances, is so much more than a single impairment in body function and structures. And it should also be clear that the effective management of pain requires an interdisciplinary approach rather than just a pill or a TENS unit. The authors skillfully argue and justify that various modalities used alone will probably not lead to clinically meaningful change in a visual analog pain scale or a sustained increase in the patient's level of activity or participation. Sluka et al. have provided a rich, evidence-based framework to understand the mechanisms for and the management of this mysterious four-letter word—pain.

Section I contains five chapters that provide an excellent and clear infrastructure for the rest of the book: identifying the relevant terms, providing clear definitions, summarizing the vast literature on putative mechanisms to describe why pain remains when the tissue is healed, and introducing the reader to the concepts of how human individual differences lead to variability in response to pain. It is fascinating to watch the story of basic science research move from the study of tail-flick behavior in the rat to indicate thermal hyperalgesia to today's sophisticated animal models in which pain is induced via a pharmacological agent or a special diet and in which mediating factors such as gender, age, and diet are examined. The behavioral studies are coupled with mechanistic studies so that insight into the spinal mechanisms is not just hypothetical; recordings from neuronal and non-neuronal cell populations, the presence of synaptic plasticity, and specific types of neuroimmune reactions are being examined in the context of pain.

Some textbooks were published on physical therapy procedures without citing a single clinical research study reference as recently as the 1970s. These earlier "how to" books did not offer guidance in selecting an intervention to match the examination findings or in selecting a particular procedure over another. If we use the earlier books as a frame of reference, the shift in physical therapy practice is dramatic. The rest of this book illustrates the shift. Section II of this text focuses attention on pain regardless of medical diagnosis, and provides guidance and evidence to support sound clinical decision making. The chapters in this section demonstrate the importance of the clinical examination, selecting the best tools to classify the pain behavior and providing help with the right tool to determine the effect of treatment outcome. Chapters on pain management in this section and Section III go beyond physical agents to provide evidence to support the use of exercise and manual therapy and to emphasize the need for interdisciplinary collaboration and the importance of including cognitive interventions. Section IV provides a series of chapters that discuss a series of pain syndromes using an evidence-based approach.

It is so exciting to see the exponential growth in research that can be used by the clinician. Mechanisms can be described that may account for the pain behavior, and evidence is available to aid in the selection of the most *effective* plan of care. We have made major strides in examining the effectiveness of particular interventions in relevant patient populations. No, we do not have the "final answers," but evidence has emerged to guide the rejection of certain modalities because studies in patients with pain do not indicate improvement with particular interventions. The interdisciplinary authors who wrote this book are conducting research at the bench or in the clinic around the world. They are

passionate about providing knowledge and skills that will be translated into clinical practice for the benefit of patients who have suffered because of our ignorance for far too long. Thank you.

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* Dickinson E. The complete poems of Emily Dickinson. Boston, MA: Little Brown; 1924. Available at www.bartelby.com/113/

PREFACE

Since the formation of the International Association for the Study of Pain (IASP) more than 40 years ago, the practice of pain management, including the role of physical therapy, has changed dramatically. Further, knowledge about the role of the peripheral and central nervous systems in processing pain signals from uninjured and injured tissue has expanded exponentially. One important recent realization is the importance of altered processing in the central nervous system, with both enhanced excitability and reduced inhibition now seen as significant contributing factors to the pain of chronic diseases. Further, the inclusion of psychosocial factors in the management of pain has greatly transformed how we approach a person with pain.

Pain severely affects function and is the main reason why people seek treatment in physical therapy. However, education about pain in physical therapy, as well as in medicine, has historically been minimal and is usually integrated into existing courses such as neuroscience, orthopedics, or physical agents. Given pain's importance in affecting an individual's function and quality of life, I believe it is important for all physical therapy students and practitioners to gain an up-to-date understanding of pain mechanisms and management. The IASP and its chapters have enhanced the understanding and treatment of pain worldwide, emphasizing an interdisciplinary approach.

A number of important events have occurred in recent years regarding pain management and education. In 2010, the IASP hosted an international summit that declared access to pain management is a fundamental human right. In 2011, the Institute of Medicine in the United States produced a blueprint for action for transforming prevention, care, education, and research to improve relief for people with pain. This, along with initiatives from the IASP, has resulted in the development of National Pain Strategies within individual countries to further transform the management of pain. In pain education, the IASP, in 2012, completely revised its curriculum guidelines for pain education for all health professionals, including physical therapy. And in 2013, an interprofessional group developed core competencies for entry-level pain education. These initiatives and the advances in research since the first publication of this book have led to the revised book.

I have developed and currently teach a stand-alone course to entry-level physical therapy students on pain mechanisms and management. This course emphasizes the latest knowledge on pain mechanisms and promotes an evidence-based and multidisciplinary approach to the management of both acute and chronic pain. This book parallels and continues to emphasize these concepts. I believe it is important to understand the mechanisms underlying pain conditions in order to better understand appropriate treatment strategies. I propose that there are essentially three potential categories into which a pain condition can fall. One group has a strong peripheral component that drives central excitability and pain. In this group, when the peripheral generator of pain is removed, the pain goes away. Acute pain syndromes commonly fall into this category. The second group has a strong central component that is independent of a peripheral pain generator. There may have been an initial peripheral pain generator, but it is no longer present, and the pain is maintained by enhanced central excitability. In this case, treatment must focus on techniques that enhance central inhibition and decrease central excitation. This category includes chronic pain conditions such as nonspecific low back pain, fibromyalgia, and temporomandibular joint disorder. The third group entails a combination of both peripheral and central sensitization so that both sites must be adequately treated in order to relieve the pain. This third group probably involves subacute as well as some chronic pain conditions. All of these conditions, whether acute or chronic, have the capacity to be modulated by psychosocial factors.

This book has been organized into four sections. The first discusses important issues in pain terminology, epidemiology, and basic science mechanisms and emphasizes the heterogeneity of pain. Importantly, this section attempts to integrate pain assessment results with basic underlying mechanisms. It further emphasizes the importance of individual pain variability by discussing differences associated with sex, gender, and age, as well as genetic determinants of variability. The second section discusses the physical therapy management of pain. We include chapters on each treatment area—education, exercise, electrical stimulation, physical agents, and manual therapy—in the management of pain. Each chapter discusses the evidence for the basic science mechanisms underlying how the treatments reduce pain, as well as the clinical evidence to support their use in patients. The third section emphasizes an interdisciplinary approach to pain, with chapters discussing the physical therapist’s role in interdisciplinary pain management, and chapters on medical and psychological management of pain. The last section includes chapters on common syndromes including myofascial pain, fibromyalgia, spinal pain, migraine, temporomandibular disorder, osteoarthritis and rheumatoid arthritis, neuropathic

pain, complex regional pain syndrome, and pain from neurological disorders. Each of these chapters describes the pathophysiology of the disease, as well as an evidence-based approach to medical management, psychological management, and physical therapy management. The final chapter of the book gives 10 case studies with explanations of the physical therapy treatment and the evidence to support that treatment. I felt it was important for this book to emphasize an evidence-based approach to the management of pain. The second edition of this book has added a number of new chapters that reflect advances in our understanding and treatment of pain. These chapters include motor control, nonspecific effects of treatment, self-management and pain, neck pain, and pain in neurological disorders.

The practice of physical therapy has changed dramatically over the last 10–15 years from one that based treatments on empirical evidence to one that bases treatments on high-quality evidence. The evidence base is incredibly important in making educated decisions in the treatment of pain. Evidence can come from strong basic science studies, experimental pain studies, and randomized controlled trials. Systematic reviews and meta-analysis combine the data from randomized controlled trials to come up with a recommendation for the use of a particular treatment in a specific condition. If there is strong evidence from systematic reviews and meta-analysis, the treatment should be used in these patients. If the primary evidence is weak or inconclusive, however, the conclusions of reviewers should be interpreted with caution because the evidence is only as good as the randomized controlled trials on which the review was based, Since the first edition of the book, there has been a substantial body of literature published on both mechanisms and clinical effectiveness of a variety of treatments. When teaching my course to physical therapy students each year, I found myself not only regularly updating all the literature in the current book but essentially replacing that literature with newer more up-to-date work, and realized a large body of evidence has been generated in just a short period of time. This growth in evidence shows the escalation of research in physical therapy and rehabilitation, and in pain management itself. This research is vitally important to the physical therapy community in terms of acceptance of techniques used in the profession, reimbursement for treatments, and the clinician’s ability to make informed decisions in the management of pain.

This book was designed to fill a gap in the education of physical therapists by supporting a more comprehensive education in the management of pain. It is designed not only to be used by students, but to be a primer for practicing physical therapists actively involved in the treatment of pain. The book will also be useful in helping other professionals involved in rehabilitation to gain a better

understanding of an evidence-based approach to the management of pain. I hope this book fills a need for physical therapy students, educators, and practitioners with an interest in an improved understanding of pain mechanisms and management.

I would like to thank the many people who made this book possible, particularly the chapter authors and coauthors who gave up their precious time to write a chapter in this book. I thank all my laboratory members who kept the experiments running while I disappeared to finalize this second edition. I thank the staff in the Department of Physical Therapy and Rehabilitation Science who diligently kept everything running behind the scenes. I also thank my husband who kept things going at home allowing me to concentrate on the revision of this book. I am also grateful for the opportunity from the IASP Press to develop this second edition to the book, and to IASP and Wolters Kluwer, particularly Nicole Dernoski, for their amazing dedication and assistance in the editing and designing of this book. I hope this book will lead to a better understanding and improved treatment of pain by physical therapists and rehabilitation professionals worldwide so that patients can get the pain relief they desperately seek.

Kathleen A. Sluka, PT, PhD, FAPTA

CONTENTS

SECTION 1

Basic Concepts and Mechanisms

CHAPTER 1

Introduction: Definitions, Concepts, and Models of Pain

Kathleen A. Sluka

Pain is a complex experience that is uniqcomplex experience that is unique to each individualue to each individual. As such, the experience of pain is difficult to both define and treat. Pain can arise as a result of damage to any tissue that is innervated by nociceptors, or can occur in the absence of tissue damage. For a clinician, the treatment of pain, particularly chronic pain, is difficult and unique to each patient. Everyone has or will experience pain at some point in their life. The impact of this pain may spread well beyond the perception of pain. For example, one may not be able to go to work, attend a significant family function, or participate in social activities because of the pain. Pain is now considered the "fifth vital sign," along with the measurement of blood pressure, temperature, heart rate, and respiratory rate. Further, the Joint Commission mandates that effective pain management is appropriate for all patients.

The International Association for the Study of Pain (IASP) was founded in 1973, under the impetus of John Bonica, to bring together clinicians and researchers in an attempt to improve the treatment of pain. From its beginnings, the IASP was multidisciplinary and international. IASP has nearly 7000 members from more than 100 countries, many of which have national chapters affiliated with IASP. As such, the IASP is the leading professional organization for science, practice, and education in the field of pain. Membership of IASP is open to all professionals involved in pain research or the diagnosis and treatment of pain. The association holds a biennial World Congress on Pain that is international and multidisciplinary, and publishes the leading journal in pain research, *PAIN*. Importantly, the IASP and its chapters have made a huge impact on the understanding of pain, pain education, and pain management worldwide. Guidelines for education are available for all disciplines, including medicine, nursing, psychology, and physical therapy, as well as interprofessional education.

These guidelines, updated in 2012, along with recently published pain competencies for entry-level education [4,11,17], will be the basis for the information presented in this book. These competencies represent the expectation of minimal capabilities for graduating health students for pain management. The competencies and IASP guidelines focus around four domains: multidimensional nature of pain, pain assessment and measurement, management of pain, and clinical conditions or context of pain. This book is therefore divided into sections to address these domains and includes basic concepts of pain, physical therapy management of pain, interdisciplinary management of pain, and pain syndromes.

EPIDEMIOLOGY OF PAIN

Pain is the number one reason that a person seeks medical attention, whether acute or chronic. As such, it should be addressed, and everyone has a right to pain relief. These principles were outlined in the Declaration of Montreal [16] and highlighted in the Institute of Medicine Report on Pain by the National Academy of Sciences in 2011 [9]. One hundred million adults in America suffer from chronic pain. This is greater than the number of individuals affected by diabetes, cancer, and heart disease combined [9,12]. Prevalence estimates for pain severity are 10% for moderate pain and 11% for severe pain [12].

A large-scale survey (35,718 respondents) of the U.S. population shows that 30% of the U.S. population has chronic pain lasting at least 6 months [18]; incidence is similar between White, African American, and Hispanic subjects [32] and in different populations worldwide [6,7,29,30,38]. Lower socioeconomic status, lower education, and unemployment are associated with higher prevalence of pain [18,32]. However, race and ethnicity do not predict disabling pain when socioeconomic and education characteristics were controlled [32]. A survey of chronic pain sufferers in the United States by the American Pain Foundation in 2006 shows that pain has a significant effect on everyday activities, interfering with recreational activities, household chores, and work (40–60%) [1]. For those suffering with chronic pain, participation in recreational activities is greatly limited (85%) and much greater than that for acute pain sufferers (59%) [1]. Similarly, for activities of daily living surveyed (running errands, performing household chores, taking care of self and others, traveling, and attending a public event), chronic pain sufferers had greater limitations than those with acute pain [1]. It should be emphasized, however, that

30–60% of respondents with acute pain have significant limitations in their activities of daily living as a result of the pain [1]. Interestingly, only 25% of respondents consulted a physical therapist or performed exercises (45% chronic pain; 14% acute pain) [1]. The incidence of pain is highest for low back pain (28%), but there is also a significant percentage of the population suffering from neck pain (15%), migraine (15%), and peripheral joint pain (30%; knee, 18%; shoulder, 9%) [31]. Gaskin and Richard [12] showed that the prevalence of joint pain was 33%, arthritis was 25%, and functional disability was 12%. Thus, both acute and chronic pain are common and can significantly impact quality of life by interfering with social and work activities. Chronic pain management is costly. Health care expenditures are greater with greater pain severity and for those with functional disability [12]. In the United States, pain costs over 600 billion dollars/year in health care costs and lost wages [9], and creates major human and economic costs for patients, families, and society [11]. Those with the most severe pain and functional disability have the highest health care costs and the largest impact on productivity (number of days missed, number of hours worked annually, hourly wages) [12].

Women, in general, have a higher incidence of pain than do men, particularly musculoskeletal pain, and women are more likely to have widespread pain than do men [3,13,18,19]. Pain incidence varies across the life span, with older adults showing a greater incidence of pain than young adults [18]. For example, 15% of women of the 18-to-24-year age group had chronic pain, whereas 42% of those 65 and older had chronic pain.

Incidence in children of chronic pain varies between 5% and 50%, with weekly headaches occurring in 23%, back pain reported in up to 20%, migraines in 8%, and 15% with pain two to three times per week [21]. Higher rates occur more commonly in girls and in those with lower socioeconomic status [21]. In community-dwelling older adults, nearly 50% seek treatment for daily pain, and 50–85% of nursing home residents experience pain [15,38]. Further, nearly 50% of nursing home residents with pain do not receive adequate pain management, and those numbers are greater for those with dementia or non-White residents [15,34,40]. Pain in children, in older adults, and those with cognitive impairments is frequently undertreated [5,10]. For example, cognitively impaired older adults with hip fractures are less likely to receive adequate pain medication than those who can verbally express their pain [28]. Undertreatment of pain has many potential detrimental consequences that affect the individual and the family. These include increased psychological distress, malnutrition, impaired sleep, impaired function, declined socialization and recreational activities, and reduced quality of life [8,15]. Thus, recognition that pain varies on