Muscle Pain: Diagnosis and Treatment
Siegfried Mense • Robert D. Gerwin
Editors

Muscle Pain: Diagnosis and Treatment

Springer
This edition of the companion volumes *Muscle Pain: Understanding the Mechanisms* and *Muscle Pain: Diagnosis and Treatment* is essential reading for those interested in clinical approaches to acute and chronic pain conditions involving muscle tissues and in the mechanisms underlying these conditions. The volumes cover a very important topic in pain medicine, since muscle pain is very common and can often be difficult to diagnose and treat effectively. Furthermore, chronic pain involving muscle and other components of the musculoskeletal system increases with age, such that it is a common complaint of those of us who are middle-aged or older. Indeed, as changing population demographics in “westernized” countries result in higher proportions of the population living longer and being middle-aged and elderly, chronic muscle pain will likely become even more of a health problem.

In the case of acute muscle pain, this can often be very intense, and in the short term can limit or modify the use of components of the musculoskeletal system associated with the sensitive muscle. Chronic muscle pain can also be intense, as well as unpleasant and disabling, and it is in many cases the over-riding symptom of most musculoskeletal disorders that are associated with long-term deleterious changes in musculoskeletal function. This can present a challenge both to the patient who has to live with the condition and to the clinician called upon to assist the patient, not only because of the physical or biomechanical impediment but also because of the presence of chronic pain reflecting persistent alterations in the peripheral muscle tissues and/or central nervous system. Chronic pain is now recognized as a multidimensional experience encompassing cognitive, emotional and motivational aspects as well as the sensory or perceptual dimension. Thus, as the editors of this work note in their preface, it can distort the patient’s life, including work, family and social relationships, and can change the patient’s perception of himself or herself from being an effective and independent human being to one who is ineffective and dependent. These features apply especially to patients with chronic muscle pain, and the range and impact of most musculoskeletal disorders and the pain that they manifest dictate that clinicians need to have a
good knowledge base about pain and adopt a broad biopsychosocial perspective in order to provide effective management of the patient. These companion volumes provide this knowledge base and perspective.

Although the etiology and pathogenesis of several muscle pain conditions are still unclear, recent advances have been made in understanding muscle pain mechanisms and in the management of the conditions. The chapters in these books collectively provide up-to-date details of these mechanisms and management approaches. The anatomy and neurophysiology relevant to muscle pain is covered in *Muscle Pain: Understanding the Mechanisms*. It offers a solid basic science underpinning for the more clinically oriented second volume, *Muscle Pain: Diagnosis and Treatment*, which outlines present knowledge of etiologic and pathophysiologic processes, and which also deals with current approaches to the management of the various conditions manifesting muscle pain.

Like its predecessor, these companion volumes should prove to be an invaluable resource not only to clinical practitioners wanting to have a basic understanding of pain mechanisms and clinical approaches currently available to diagnose and manage muscle pain problems, but also to basic and clinical pain scientists who are interested in an up-to-date and comprehensive review of the diagnostic and management approaches to muscle pain.

Toronto

Barry J. Sessle
Disorders of the musculoskeletal system are the leading causes of disability in western societies. Musculoskeletal pain syndromes can be divided into two broad categories: (1) myalgias, which include the major condition of myofascial pain syndromes, as well as inflammatory and other myosites, and (2) articular disorders, which include all of the arthritides. Fibromyalgia has long been considered a chronic musculoskeletal pain syndrome, but recent research supports categorizing fibromyalgia as a widespread chronic pain syndrome. Ergonomic and postural and other structural dysfunctions, including pain associated with the hypermobility syndromes, can bridge these two categories, although they tend to fall more into the myalgic group of disorders.

A problem for the practitioner trying to understand a patient’s pain is that pain is a subjective sensation that is colored by the patient’s personal life experience, and ethnic and cultural background. Chronic pain is not simply a sensation, but a global experience that involves suffering and a distortion of the patient’s role in all phases of life, including family, work and social relationships, and can change the patient’s self perception of him- or herself from being an independent, effective human being, to being a dependent, ineffective person. Communication is particularly difficult with chronic pain patients, because chronic pain is such a personal experience of global suffering, rather than a simple sensation like touch. There is a definite effect of gender on pain perception. Therefore, when examining muscles in patients for painful conditions, the greater sensitivity of women to painful stimuli has to be taken into account.

Pain from muscle and skin is subjectively and objectively distinct. Muscle pain is described as aching and cramping, diffuse and poorly localized, whereas cutaneous pain is described as sharp and pricking, and precisely localized. Cutaneous pain is usually not referred to other body regions, while muscle pain is commonly referred to other deep somatic structures like tendons and fascia or other muscles, and viscera (viscerosomatic pain syndromes). Objective differences between muscle and cutaneous pain exist in the processing of neuronal information at the spinal
and brainstem level and continue up to the brain, where nociceptive activity from skin and muscle terminates in different regions. Some of the established pain terms used in this book are defined in chapter 1 of the volume “Muscle Pain: Understanding the Mechanisms”.

Heidelberg/Mannheim

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## Contents

1 Introduction .................................................. 1  
Siegfried Mense and Robert D. Gerwin

**Part I  Myofascial Pain Syndrome**

2 Myofascial Pain Syndrome ................................. 15  
Robert D. Gerwin

3 Morphology of Myofascial Trigger Points: What Does  
a Trigger Point Look Like? ............................... 85  
Siegfried Mense

**Part II  Fibromyalgia Syndrome**

4 Fibromyalgia Syndrome: Clinical Aspects and Management .... 105  
Emma Guymer and Geoffrey O. Littlejohn

5 Gender, Genetics, and Other Risk Factors Increasing  
Vulnerability to Fibromyalgia ........................... 143  
Geoffrey O. Littlejohn

**Part III  Other Muscle Pain Syndromes**

6 Low Back Pain of Muscular Origin ...................... 161  
Robert D. Gerwin

7 Masticatory Muscle Pain ................................. 193  
Sandro Palla and Mauro Farella
8 **Inflammatory Myopathies** .............................................. 229  
Ingrid E. Lundberg and Li Alemo Munters

9 **Whiplash Injury, Muscle Pain and Motor Dysfunction** .......... 247  
Jan Dommerholt

10 **Brain Imaging of Muscle Pain** ........................................ 289  
Sandra Kamping and Herta Flor

**Glossary** ................................................................. 311

**Index** ................................................................. 361
Contents to
Muscle Pain: Understanding the Mechanisms

1 Introduction
Siegfried Mense and Robert D. Gerwin

2 Functional Anatomy of Muscle: Muscle, Nociceptors and Afferent Fibers
Siegfried Mense

3 Peripheral Mechanisms of Muscle Pain: Response Behavior of Muscle Nociceptors and Factors Eliciting Local Muscle Pain
Siegfried Mense

4 Central Nervous Mechanisms of Muscle Pain: Ascending Pathways, Central Sensitization, and Pain-Modulating Systems
Siegfried Mense

5 Referral of Musculoskeletal Pain
Thomas Graven-Nielsen and Siegfried Mense

6 Increased Muscle Tone as a Cause of Muscle Pain
Siegfried Mense and Alfonse T. Masi

7 Reorganized Motor Control Due to Muscle Pain
Thomas Graven-Nielsen and Lars Arendt-Nielsen

Glossary

Index
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Chapter 1
Introduction

Siegfried Mense and Robert D. Gerwin

Contents

1.1 Established Pain Terms (Partly after Merskey and Bogduk 1994; and Loeser and Treede 2008) ................................................................. 2
1.1.1 General Terms .................................................................................. 2
1.1.2 Diagnostic Terms ............................................................................... 3
1.1.3 Established, but Often Ill-Defined, Terms ........................................ 5
1.2 Importance and Prevalence of Muscle Pain ........................................ 5
1.3 Gender Differences .............................................................................. 6
1.4 Pain Measurement ................................................................................ 6
1.5 Aggravating and Perpetuating Factors ................................................ 7
1.6 Patient History ..................................................................................... 8
1.7 Examining Patients with Musculoskeletal Pain .................................... 8
1.8 Distinguishing Between Different Types of Pain (Local, Projected, Referred, and Central) ................................................................. 9
1.8.1 Local Pain and Tenderness ................................................................. 9
1.8.2 Projected Pain .................................................................................. 9
1.8.3 Referred Pain and Tenderness .......................................................... 10
1.8.4 Central Pain .................................................................................... 10
References .................................................................................................. 10

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Abstract  Disorders of the musculoskeletal system are the leading causes of disability in Western societies. Musculoskeletal pain syndromes can be divided into two broad categories: (1) myalgias, which include the major condition of myofascial pain syndromes, as well as inflammatory and other myosites, and (2) articular disorders, which include all of the arthritides. Fibromyalgia has long been considered a chronic musculoskeletal pain syndrome, but recent research supports categorizing fibromyalgia as a widespread chronic pain syndrome. Ergonomic and postural and other structural dysfunctions, including pain associated with the hypermobility syndromes, can bridge these two categories, although they tend to fall more into the myalgic group of disorders.

A problem for the practitioner trying to understand a patient’s pain is that pain is a subjective sensation that is colored by the patient’s personal life experience, and ethnic and cultural background. Chronic pain is not simply a sensation, but a global experience that involves suffering and a distortion of the patient’s role in all phases of life, including family, work and social relationships, and can change the patient’s self perception of him- or her-self from being an independent, effective human being, to being a dependent, ineffective person. Communication is particularly difficult with chronic pain patients, because chronic pain is such a personal experience of global suffering, rather than a simple sensation like touch. There is a definite effect of gender on pain perception. Therefore, when examining muscles in patients for painful conditions, the greater sensitivity of women to painful stimuli has to be taken into account.

Pain from muscle and skin is subjectively and objectively distinct. Muscle pain is described as aching and cramping, diffuse and poorly localized, whereas cutaneous pain is described as sharp and pricking, and precisely localized. Cutaneous pain is usually not referred to other body regions, while muscle pain is commonly referred to other deep somatic structures like tendons and fascia or other muscles, and viscera (viscerosomatic pain syndromes). Objective differences between muscle and cutaneous pain exist in the processing of neuronal information at the spinal and brainstem level and continue up to the brain where nociceptive activity from skin and muscle terminate in different regions. Some of the established pain terms used in this book are defined in this chapter.

1.1 Established Pain Terms (Partly after Merskey and Bogduk 1994; and Loeser and Treede 2008)

1.1.1 General Terms

Mixed pain
The term is mainly used for a combination of neuropathic and nociceptive pain, i.e., for pain due to a lesion of the central or peripheral nervous system, combined with pain caused by excitation of nociceptive nerve endings.

Dysesthesia
An unpleasant abnormal sensation, whether spontaneous or evoked.
Causalgia
A syndrome of sustained burning pain, allodynia, and hyperpathia after a traumatic nerve lesion, often combined with vasomotor and sudomotor dysfunction and later trophic changes. This is now called complex regional pain.

1.1.2 Diagnostic Terms

1.1.2.1 Myofascial Pain

Two applications of the term “myofascial pain syndrome” are being used (Simons 1995). Originally, it was used in a specific way to describe the symptoms caused by trigger points (TrPs; Simons et al. 1999; Travell and Simons 1992; see Chaps. 2–4). In recent years, a number of authors have adopted a general definition that includes a regional pain syndrome of any soft-tissue origin. Because of these two applications, authors should clearly identify whether their use of the term “myofascial pain” applies specifically to TrPs, or is being used in the more general sense. The term “trigger point pain syndrome” or “myofascial trigger point pain syndrome” may be used to be more specific.

1.1.2.2 Fibrositis

The term fibrositis is outdated, and mentioned here just for historic reasons. The original description by Gowers (1894) suggests that he viewed it like a sort of (nonspecific) low back pain. Later, it was described in terms that were most compatible with TrPs, but included fibromyalgia. The term was also used to describe a disorder that resembled fibromyalgia (Smythe and Moldofsky 1977). However, the term “fibrositis” is unsuitable as a label for fibromyalgia, because the suffix “itis” implies an inflammatory process for which there is no evidence in the case of fibromyalgia.

1.1.2.3 Fibromyalgia

The classification criteria for fibromyalgia were published in 1990 (Wolfe et al. 1990). The patient must have widespread pain of at least 3 months duration. The American Rheumatological Association (ACR) criterion of tenderness to moderate palpation (about 4 kg pressure) at 11 of 18 specified body sites was established to
ensure uniformity of subject selection for research purposes. Criteria for clinical purposes have never been established rigorously. However, the generally used clinical criteria are that musculoskeletal pain must be chronic and must be widespread. Widespread pain means that over time at least three of the four body quadrants must be involved. That is ensured by finding 11 of the 18 predetermined sites to be tender. They do not have to be tender all at the same time. The Canadian Criteria have included associated symptoms such as morning stiffness, nonrestorative sleep, fatigue, and cognitive impairment in keeping with the concept that fibromyalgia is more than a muscle pain syndrome, but one that affects many different systems. Many laboratory abnormalities have been found in fibromyalgia, e.g., serotonin deficiency (Russell 1996) and increased levels of substance P (SP) and nerve growth factor (NGF) in the cerebrospinal fluid (Giovengo et al. 1999). These findings support the assumption that fibromyalgia is associated with CNS dysfunction, which causes a pathological increase in pain sensitivity throughout the body.

1.1.2.4 Myogelosis and “Muscle Indurations”

Painful condition of muscle characterized by a localized tender spot in palpable ropiness of the muscle. A myogelosis is likely to be a myofascial TrP or — if it is a large one — an aggregation of several TrPs.

1.1.2.5 Nonarticular Rheumatism (Soft Tissue Rheumatism)

A more general term comparable to the outmoded “fibrositis.”

1.1.2.6 Non-Specific Low Back Pain

Low back pain due to painful disorders of the soft tissues (muscles, fascia, ligaments) of the low back, in which specific causes of low back pain such as displacement of intervertebral disc, spondylolisthesis, bony metastasis, abscess or other such causes of low back pain are not present.

1.1.2.7 Tendomyopathy

The term usually distinguishes between generalized and localized tendomyopathy. Generalized tendomyopathy is often considered synonymous with fibromyalgia.
1.1.2.8 Work-Related Disorders of the Musculoskeletal System

In most cases, muscle pain caused by poor ergonomics of the work place which leads to tonic contractions of a muscle or parts of a muscle, and results in painful overload. No high contractile forces are required for this disturbance to develop. Myalgia from this mechanism can involve myofascial TrPs.

1.1.3 Established, but Often Ill-Defined, Terms

1.1.3.1 Referred Pain

Referred pain is not felt at the site of a tissue lesion but remote from it. The area of referred pain is often discontinuous with the site of the lesion. Referred pain can occur together with local pain (at the lesion site) or in isolation. Since pain originating in a given muscle tends to exhibit a relatively constant pattern of referral, it is often possible to identify the muscle from which the pain originates if the pattern is known. If the pain is referred from one site to several remote locations it is often described as “radiating.” Referred pain is usually — but not always — segmental, occurring in myotomes innervated by the same nerve root or neighboring nerve roots as innervated the original source of pain. TrPs in axial (trunk) muscles can thus refer pain through the body, so that TrPs in dorsal muscles can have a ventral body representation. Thus, referred pain is due to a central nervous mechanism (see Chap. 5 in the companion volume by Mense and Gerwin (2010)) and does not necessarily occur in the same segment, whereas projected pain occurs exclusively in the innervation territory of a lesioned nerve or dorsal root.

1.2 Importance and Prevalence of Muscle Pain

Musculoskeletal disorders are the leading causes of disability in people in their working years (Weigl et al. 2007). The clinical conditions can be grouped into two main categories, nonarticular and articular. Nonarticular disorders affect soft tissues like muscles, fasciae, tendons, ligaments, bursae, and nerves. Common examples include nonspecific low back pain, myofascial pain syndrome caused by TrPs, and fibromyalgia syndrome characterized by tender points (TePs). Articular disorders include rheumatoid arthritis and osteoarthritis.

Low back pain was traditionally assumed to be mainly due to disorders of the osseous and articular structures of the spine, but recently, muscles and fascia of the low back are being more and more appreciated as sources of low back pain (Borg-Stein and Wilkins 2006; Itoh et al. 2006). Low back pain caused by disorders of lumbosacral soft tissues is the most common nonarticular condition, accounting for $240 billion US of health expenditures annually in the US alone (Yelin 2003).
Myofascial pain, characterized by the presence of myofascial trigger points (MTrPs) can remain unrecognized if the physician does not actively look for them. Myofascial pain is a relatively common cause of regional musculoskeletal pain, occurring in up to 9% of general medical clinic patients (Skootsky et al. 1989).

Fibromyalgia occurs in 2–3% of the adults in the US (Lawrence et al. 2008). It accounts for approximately 15% of the patients seen in rheumatology clinics and 6–10% of all patients in general internal medicine clinics (Campbell et al. 1983). The direct annual costs for health care per patient in 6 months amount to approximately $2,300 CDN (Penrod et al. 2004). Widespread chronic pain and hypersensitive TePs, most of which are found at the origin or insertion of muscles, are diagnostic of this condition (Guymer and Littlejohn 2002; Wolfe et al. 1990). Fibromyalgia patients suffer not only from widespread deep somatic pain, but also from disorders of other organ systems. There can be a considerable overlap of MTrP pain in fibromyalgia patients.

### 1.3 Gender Differences

Differences in the physiology of pain and in responses to analgesic treatment between men and women are now generally accepted (Berkley 1992; Munce and Stewart 2007). A large number of studies show that women have greater sensitivity to muscle pain than men. For instance, the average pressure pain threshold in healthy men was found to be significantly higher than that in women (Komiyama and De Laat 2005). These findings show that findings obtained in studies of males cannot be applied directly to females.

The greater pain sensitivity of women may explain why females are overrepresented among fibromyalgia patients. The key symptom of this disorder is an increased pain sensitivity, probably mediated by a dysfunction of the nociceptive processing in the CNS. The gender difference applies also to muscle pain syndromes other than fibromyalgia, e.g., to many types of orofacial pain (Cairns 2007; Shinal and Fillingim 2007). Most women experience more pain than men do in response to the same noxious stimulus. Pain sensitivity in women is influenced by hormonal effects as well as by psychosocial factors. Pain responses may vary during different stages of the menstrual cycle. This gender difference has a physiological basis, and does not mean that women have a propensity to complain more (for details, see Chap. 7).

### 1.4 Pain Measurement

The visual analog scale (VAS) is a simple and popular tool for measuring the (subjective) severity of a patient’s pain (Gracely 2006). The patients assess the severity of their pain in terms of their own personal standards. A patient is asked to
mark on a line, usually 10 cm long, the intensity of pain he or she feels. Zero represents no pain and 10 the most severe pain that the patient can imagine. The number of millimeters the patient’s mark lies from the zero end of the scale is taken as a measure of the severity of pain. For small children and for those of limited capacity for other reasons, a modified VAS has been developed that shows smiling, neutral, or sad faces instead of distances from fixed end-points. Numerical pain scales (NPS) are similar to the VAS, but use an 11-point Likert scale of 0–10 to denote intensity of pain. In telephone surveys, where a manual response is impossible, often verbal–numerical rating scales (NRS) are used. In such surveys, the patients are informed to describe the intensity of their pain with words (e.g., no pain, moderate pain, extremely intense pain). The words used can be transformed into numbers (Gracely 2006).

1.5 Aggravating and Perpetuating Factors

A situation often encountered in chronic muscle pain is comorbidity. A patient who has both fibromyalgia and TrPs has more severe symptoms and has a pain problem that is more difficult to treat than one who has only one or the other. Another example is the presence of both an articular dysfunction and TrPs of the muscles that are functionally related to that joint.

The identification and resolution of factors that perpetuate the activity of TrPs is often of critical importance in preventing an acute TrP pain situation from evolving into a chronic pain problem. The two key factors are mechanical and systemic (Travell and Simons 1992; Simons et al. 1999). Mechanical perpetuating factors include poor posture, body asymmetries or disproportions, and disturbed muscle function. Poor posture (e.g., head-forward and round-shouldered) leaves some muscles in a shortened position for prolonged periods and others under chronic tension. True or pseudo leg-length inequality that may cause structural dysfunction or be related to muscle shortening or pelvic torsion can be associated with compensatory contraction and overload in muscles from the lower extremity to the head. The recognition of muscle weakness caused by motor inhibition by nociceptive activity from a TrP is often a critical step in the restoration of normal function, because other muscles suffer from compensatory overload. Strengthening the inhibited muscle with an exercise program often reinforces the abnormal motor behavior, and makes it more difficult for the patient to recover normal function.

Among the systemic perpetuating factors are a number of conditions that compromise muscle energy metabolism. These include anemia, low serum ferritin, inadequate thyroid function, vitamin B1 inadequacy, inadequacy of folic acid, vitamin D, and/or vitamin B12 (Travell and Simons 1992; Gerwin 2005). These systemic factors are presumed to be relevant on clinical grounds, but the relationships are not firmly established by clinical studies. The minimum need is variable from patient to patient, and patients with a greater need (and therefore a relatively
greater inadequacy) are probably more vulnerable than others to perpetuating factors. The TrP causes the pain, but the perpetuating factor facilitates chronicity. Resolution of the perpetuating factors may be required to prevent or treat chronicity.

1.6 Patient History

In patients with chronic muscle pain, a specific muscle history is needed. The muscle history establishes the details of the situation at the onset of the pain, the relation of the pain to muscular activity and/or position, a detailed pain pattern, and the severity and constancy of the pain.

The exact posture, movement or forceful activity at the time of onset of the pain is used as a guide to indicate which muscle(s) were most likely overloaded. The referred pain patterns help to identify the involved muscle(s). Exploration of an individual’s work or recreational activity, and the specific manner in which tasks are accomplished, can be critical in identifying provoking and perpetuating factors.

1.7 Examining Patients with Musculoskeletal Pain

An adequate examination of a patient suffering from chronic muscle pain requires skills in many fields. The clinician has to examine for

1. Functional muscle imbalance in the kinesiological sense
2. Neurological function
3. Myofascial TrPs
4. Fibromyalgia, and
5. Articular dysfunction

1. The examination for functional muscle balance detects weak muscles, inhibited muscles, compensatory movement patterns, and muscles recruited in abnormal sequence. These dysfunctions help to identify which muscle(s) is/are the source of pain.

2. The neurological examination is essential for an adequate differential diagnosis. Projected pain or hypoesthesia along the course of a spinal nerve must be distinguished from the referred pain pattern of a TrP. The weakness of muscles in the distribution of a given nerve must be distinguished from the dysfunctional patterns of weakness induced by TrPs, which is related to functional muscle groups regardless of innervation.

3. The examination for identifying myofascial TrPs is described in detail in Chaps. 2 and 3. The most essential part of the examination is the manual palpation of the muscles to detect changes in muscle tone and painful areas.
4. When examining for fibromyalgia, the physician must determine the extent of involvement in the body by tenderness to usually nonpainful digital pressure. Examination of sites other than the 18 prescribed sites in the ACR criteria allows a more generalized assessment of the body above and below the waist, and on the left and right sides, in keeping with the concept that fibromyalgia is widespread pain. The most important differential diagnosis in these cases is myofascial pain due to TrPs. Myofascial pain can also be widespread, affecting three or four quadrants of the body. Fibromyalgia can be distinguished from active TrPs by the absence of a palpable taut band, the lack of referred pain from the TePs to another body site, and the widespread, often symmetric nature of TPs in fibromyalgia (for more details, see Chaps. 5–7).

1.8 Distinguishing Between Different Types of Pain (Local, Projected, Referred, and Central)

1.8.1 Local Pain and Tenderness

The distinction between local and referred pain and tenderness is important, since the cause of referred pain is rarely where the patient feels the pain. Muscle pain and tenderness can be referred from TrPs, articular dysfunctions, and enthesitis; therefore, the examiner must examine these sites for evidence of a condition that can evoke referred muscle pain and tenderness. Local pain and/or tenderness in muscle is often caused by TrPs, which can be reliably diagnosed by the palpable taut band (Gerwin et al. 1997), by an inflammatory process such as bursitis, which is not associated with a palpable taut band, and by painful muscle spasm, which causes a uniformly tense muscle and has associated measurable EMG activity.

1.8.2 Projected Pain

The most important distinction is that between projected pain and referred pain. Projected pain is caused by irritation or lesion of a spinal nerve or dorsal root that initiates centripetal (and centrifugal) action potentials at the site of lesion. The afferent input is interpreted by the cortex as originating at the receptive endings of the irritated (excited) nerve fibers. Therefore, projected pain is felt in the innervation territory of the affected nerve or dorsal root. An example is the shock felt down the ulnar side of the forearm and hand when one impacts the ulnar nerve at the elbow. Referred pain from a TrP has a pattern that is not restricted to a nerve distribution. The sharp projected pain from a nerve lesion can be reproduced by mechanical stimulation of the affected nerve (Tinel’s sign).
1.8.3 Referred Pain and Tenderness

Referred pain from muscle can be identified as such when the pain can be reproduced by pressure on the peripheral source of the pain. Referred pain from muscle generally has a diffuse aching quality. Referred pain and tenderness from visceral lesions can look very confusingly like referred pain and tenderness of muscular origin. An example is appendicitis which can be mimicked by active TrPs in the muscles of the lower right quadrant of the abdomen. Thus, myofascial pain and visceral pain can mimic each other (viscerosomatic pain syndromes).

1.8.4 Central Pain

Central pain that is perceived by the patient to be in muscles is characterized by a combination of the lack of a peripheral source (which can easily be overlooked because there are so many potential sources) and a history of a lesion that can be expected to generate central pain. Frequent sources of central pain include CNS lesions, or a painful peripheral lesion with subsequent interruption of its connection to the CNS. The latter type of central pain is present in amputees who were suffering severe pain in a limb immediately before amputation, and then have a painful phantom limb that retains the preamputation pain (Nikolajsen and Jensen 2006).

References

Introduction


Part I
Myofascial Pain Syndrome
Chapter 2
Myofascial Pain Syndrome

Robert D. Gerwin

Contents

2.1 Introduction ................................................................. 17
  2.1.1 Trigger Point Manifestations ........................................ 18
  2.1.2 Trigger Point Pain ................................................... 18
  2.1.3 Current State of Knowledge ........................................ 19

2.2 Clinical Presentation .................................................... 20

2.3 Definition ............................................................... 20
  2.3.1 Primary Trigger Point Characteristics ............................. 20
  2.3.2 Additional Trigger Point Characteristics .......................... 21
  2.3.3 Trigger Point Identification ......................................... 23
  2.3.4 Weakness ............................................................ 24
  2.3.5 Recruitment ......................................................... 24
  2.3.6 Reciprocal Inhibition ............................................... 24
  2.3.7 Range of Motion .................................................... 25
  2.3.8 Functional Adaptation .............................................. 25

2.4 Sensory Changes .......................................................... 25

2.5 Electrophysiology of the Trigger Point: Spontaneous
  Electrical Activity (Endplate Noise) ..................................... 26

2.6 Etiology of Myofascial Trigger Points .................................. 28
  2.6.1 Generation of the Taut Band ....................................... 28
  2.6.2 Muscle Overuse Syndromes and Myofascial
        Pain Syndrome ....................................................... 28
  2.6.3 The Neuromuscular Junction: The Role of the
        Neuromuscular Junction in Trigger Point Formation ............ 28
  2.6.4 Peripheral Nerve Sensitization in Myofascial
        Pain Syndrome ....................................................... 30
  2.6.5 Hypoxia and Ischemia .............................................. 30
  2.6.6 Biochemistry of the Trigger Point Region ........................ 31

2.7 Muscle Pathology ........................................................ 33

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Abstract Myofascial pain syndrome (MPS) is a form of myalgia that is characterized by local regions of muscle hardness that are tender and that cause pain to be felt at a distance, i.e., referred pain. The central component of the syndrome is the trigger point that is composed of a tender, taut band. Stimulation of the band, either mechanically or with activity, can produce pain. The active trigger point has identifiable pathophysiologic changes. The concentrations of a number of substances are measurably elevated in the milieu of the active trigger point, namely substance P, CGRP, bradykinin, and assorted cytokines, indicating that there is a chemical inflammatory response. The pH of the trigger point milieu is low, about pH 5. This is in keeping with the findings that the trigger point is hypoxic and ischemic, and therefore acidic. The trigger point has a unique electromyographic feature of persistent, low-amplitude, high frequency discharges that look like endplate potentials. The taut band conducts energy faster than the surrounding muscle tissue does because it is stiffer. The taut band can also be visualized using high definition ultrasonography. Clinical diagnosis of a MPS is made by history and by palpation of muscle to identify the taut band. Predisposing and perpetuating factors such as iron insufficiency, vitamin D deficiency, and chronic pelvic pain are considered and addressed if found. The goal is to eliminate the trigger points, reverse trigger point-induced weakness and incoordination, and restore normal muscle function. Manual trigger point releases, and needling the trigger point, without or with local anesthetic, and use of low-level laser are effective ways of inactivating trigger points and reducing pain. MPSs can mimic or cause many common conditions such as chronic daily headache and pelvic pain because of the pain referral patterns of the trigger points.

2.1 Introduction

Muscle pain is a common problem that is underappreciated and often undertreated. Myofascial pain syndrome (MPS) is a myalgic condition in which muscle and musculotendinous pain are the primary symptoms. The heart of the syndrome is the myofascial trigger point. The trigger point is a small, painful, locus of abnormal muscle which is the source of the muscular dysfunction. Current thinking about MPS is that a small region within the muscle harbors multiple foci of trigger points, more accurately called trigger zones, which generate pain. The trigger point itself is a tender region in a taut band in skeletal muscle (Simons et al. 1999). The taut band is formed by a group of contracted muscle fibers, and is readily palpable. There may be a degree of nodularity in the taut band, particularly at the region of greatest hardness, which is also usually the region of greatest tenderness. However, nodularity is by no means always palpable, and is certainly not required for the identification of the trigger point. Tenderness is usually greatest at the region of maximal hardness or greatest resistance to palpation. Andrew Fischer measured the stiffness of the taut band with a compliance meter, emphasizing the hardness of the
discrete band of muscle that harbors the tender region (Fischer 1987). Thus, the trigger point is a focus of sensory hyperirritability on a discrete, hyperactive region of muscle.

2.1.1 Trigger Point Manifestations

The trigger point is responsible for the clinical symptoms of MPS (Table 2.1). Local tenderness is quintessential to the trigger point. Pain at a distance is characteristic of MPS. It represents referred pain that is the result of trigger point-induced central sensitization. Nociceptive activity that arises in foci of painful muscle activates spinal cord dorsal horn neurons and sensitizes the central nervous system, causing central sensitization, hyperalgesia, and referred pain. Muscle weakness without atrophy occurs due to trigger point induced motor inhibition. Restricted range of motion occurs because of the shortening of the contracted taut band, and perhaps because of pain. The range of motion of hypermobile individuals must be interpreted cautiously, because it can appear to be normal, but can still be restricted for such an individual. Impaired reciprocal inhibition results in cocontraction of agonists and antagonists, thus interfering with fine motor control and coordination. Autonomic disturbances can accompany trigger point activation, leading to changes in skin temperature and color, piloerection (goosebumps), and lacrimation.

2.1.2 Trigger Point Pain

The trigger point causes pain. At its most activated state, it causes pain at rest. Less severe, it causes pain as the muscle is used. Such trigger points that cause spontaneous pain are called active trigger points. A trigger point that is not spontaneously painful with use or at rest is termed latent; it is recognized by a taut band in the muscle. It does not reproduce the patient’s usual pain, but is painful when activated by mechanical stimulation such as palpation or needling (Simons et al. 1999). This descriptive terminology illustrates the dynamic nature of the trigger point, changing in its degree of irritability or activity, and raising the question of what the minimum

<table>
<thead>
<tr>
<th>Motor</th>
<th>Sensory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taut band</td>
<td>Localized pain</td>
</tr>
<tr>
<td>Twitch response</td>
<td>Referred pain</td>
</tr>
<tr>
<td>Weakness without atrophy</td>
<td>Central sensitization</td>
</tr>
<tr>
<td>Loss of reciprocal inhibition</td>
<td>Peripheral sensitization</td>
</tr>
<tr>
<td>Electromyographic endplate noise</td>
<td>Subject to sympathetic modulation</td>
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<tr>
<td>Subject to sympathetic modulation</td>
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</tbody>
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