Temporomandibular Disorders
Manual therapy, exercise, and needling

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What emerges from the pages of this absorbing book is a revelation. There is a proverb, attributed to various cultures, that states ‘It takes a village to raise a child’ and, as this textbook illustrates, it takes a large team to comprehensively describe temporomandibular disorders (TMDs) and to accurately and safely examine, identify, understand, treat, and manage these extremely widespread musculoskeletal pain conditions, that are (depending on the diagnostic criteria) second only to nonspecific low back pain in prevalence worldwide, affecting approximately 10 per cent of the adult population.

The opening chapters set the scene by clearly outlining and detailing the examination, classification, including trigeminal nociceptive processing, pathophysiology, sensory testing, and referred pain associated with TMDs (and orofacial pain). Now, it might be thought that defining TMDs would be straightforward. However, as is forensically explained in the first chapter – Definition, epidemiology and etiology of painful temporomandibular disorders – in order to manage these conditions effectively, it is vital that clinicians understand and appreciate the multiple factors that can influence the evolution and maintenance of the dysfunction and pain associated with TMDs.

Before the chapters that detail the effective examination and manual therapy treatment and management of TMDs, it becomes apparent that, critical to optimal management, there must be awareness that a TMD is rarely an isolated disorder with a single ‘cause’, but is usually the result of a wide range of interacting adaptations, factors, and influences. Some of these etiological features may be preventable, and/or reversible, while some are historical (injury for example) or inherent. For example, there are unexpected ethnic and racial differences, with a clear discrepancy between the incidence of TMDs amongst, e.g., African Americans (3.8 per cent), mixed-race White/Native Americans (12.7 per cent), and Asians (2 per cent). Other potentially significant influences range from educational, occupational and socioeconomic features, to body weight, physical activities, coexisting conditions, habits such as smoking, as well as biomechanical and psychological factors. Unsurprisingly, these same features are also common risk factors for nonspecific low back pain and chronic neck pain.

The chapters on examining for TMD and orofacial pain clearly describe the need for a comprehensive clinical history, together with a detailed evaluation of the temporomandibular joint itself, the masticatory muscles, and the vital structural and functional connections to the cervicothoracic spine, including possible influences such as posture, neurology, ligamentous stability, arterial dysfunction, segmental ranges of motion and mobility, and the functionality of the deep neck flexor muscles. All, or any, of these topics can potentially be major features in the evolution of TMDs, making their assessment essential for an understanding of the particular influences in any given case.

The chapters covering manual therapy interventions provide evidence-informed details regarding therapeutic exercise, joint manipulation and mobilization, management of referred pain (trigger points), as well as a range of soft tissue methods, postural re-education and training. Among these insightful manual therapy chapters there is also a clear and detailed exposition of the role of fascial anatomy in relation to the cranio-cervico-mandibular region. This chapter includes an extraordinarily detailed and complex outline of fascia in relation to the act of chewing, as a part of the survey of multiple dynamic fascial links, connections and functions in the mouth, throat, head, and neck. Also receiving appropriately detailed coverage in relation to TMD management are dry needling, and – usefully in a separate chapter – acupuncture, as well as current...
perspectives on pain psychology and treatment of the brain. One of the final chapters – Treating the brain in temporomandibular disorders – includes a fascinating exploration of pain neuroscience education and brain exercises.

As a clinician, this reader now has a far clearer understanding as to the host of influences governing the complex issues around TMDs. This fine textbook has been brilliantly conceived and thoughtfully realized, and all concerned deserve congratulations.

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I am very pleased, and honored, to be writing a foreword to this book. The gap between our theoretical knowledge of mechanisms, treatment efficacy, and effectiveness outcomes, and our practical clinical experience in how to apply physical therapy in temporomandibular disorder (TMD) pain patients has long needed such a discussion as this book provides. The wide array of treatment modalities in the domain of physical therapy can be confusing when considering which of the available therapies is best suited to a particular situation. This book focuses on best uses of manual therapy, therapeutic exercises, postural training, dry needling, and acupuncture in the treatment of chronic TMD pain patients.

A large epidemiological study of 46,394 participants in Europe reported that 19 percent of the population had moderate to severe chronic pain. Two-thirds used non-medication treatments, for example massage (30 percent), physical therapy (21 percent) and acupuncture (13 percent), and 38 percent reported that it had been extremely helpful. Interestingly, the type of physical therapy and the prevalence of its use ranged widely between countries, indicating large cultural differences. Most physical therapies are designed to treat various musculoskeletal pain disorders in the body. Although many features of the masticatory system are admittedly unique, we have learned that the mechanisms by which nociceptive impulses are initiated, transmitted, and perceived are not, as pain is more or less common throughout the body. This indicates that interventions which have been found to be useful at other sites in the body may also be useful in TMDs. Although evidence is limited, some modalities of physical therapy, such as jaw exercises, have been recommended in Swedish national guidelines in health care and as an integrated part of self-care in several publications. Based upon moderate evidence, the Swedish national guidelines for the treatment of orofacial pain currently recommend jaw exercises for TMDs, particularly from a health-economic perspective.

Several physical therapy modes are reportedly beneficial because they often activate the endogenous pain inhibitory modulation system; have few side effects; activate the patient by increasing body awareness and providing new pain-relief tools for home use; and facilitate communication with care providers. An additional benefit is that multimodal treatment with other therapies becomes easier and potentially more effective.

Chronic pain is often complex with comorbid pain conditions. An optimum treatment outcome almost always requires multidisciplinary collaboration with other medical disciplines. Although this book provides information on physical therapies useful for TMD patients and targets TMD professionals, such treatment may be delivered by other health professionals who may find the information contained between the covers of this book useful.

The book is divided into four parts, each containing several chapters. The first part deals with the epidemiology and classification of TMDs, nociceptive processing, and the pathophysiology of the masticatory system. These chapters provide the clinician with a deep understanding of the basic science of chronic pain. Part 2 focuses on the clinical case history and the clinical examination of the masticatory system and upper cervical region. The chapters in Part 2 detail the currently tested and accepted methods for assessing and examining the patient. Part 3 reviews various manual therapies for TMDs and neck disorders. This section highlights the available evidence-based literature and provides readers with scientifically sound and effective support for the use of these therapies. Part 4 discusses other interventions, such as acupuncture, and in addition,
the final chapter uses a biopsychosocial perspective to set up a framework for integrating physical therapies with other therapies in the management of chronic TMD pain patients.

Although the field of TMDs and orofacial pain has made great strides in the last few decades, clinical situations continue to remind us of the limits to our knowledge. As clinicians, we meet patients seeking help with pain and suffering on a daily basis. We must determine, to the best of our ability – based on the best scientific evidence available, our own clinical experience, and potential value to the patient – the treatment that will best provide an optimal outcome and quality of life for just this patient sitting in our chair. The present book was conceived and written for this purpose.

Treatment needs to be tailored for the individual chronic pain patient; this often implies different approaches or combinations of treatment modes such as behavioral therapies, pharmacologic treatment, occlusal therapy (splints), and physical therapy. One guideline overshadows all else: Select – always – the most conservative approach, and above all, do no harm. Patients need to feel believed, to know that all attempts to arrive at a correct diagnosis have been made, and to understand that appropriate treatment or referral to other specialists and therapists has been done when necessary.

I congratulate the contributing editors and authors, many of whom are recognized, leading experts in their fields and have contributed significantly to our current knowledge through their research and scientific publications. This book is a gem in its field, providing effective, trustworthy information to clinicians that will help alleviate orofacial pain and the suffering of their patients, and thus to some measure, or substantially, improve the daily experience of chronic pain patients.

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During my professional career, I have had the opportunity to witness some very positive changes for our patients. One of these has been the blending of professional efforts in the area of orofacial pain. As we attempted to better understand pain, we began to appreciate the complexity of this field. Pain is one of the most powerful negative emotions we humans experience, yet we often struggle to help our suffering patients. We have come to learn that pain is far more than a sensation. Instead, pain is actually an experience, far more complex than a simple sensation. We have also learned that common sources of peripheral injury, thought to be the source of most pains, are not the problems we clinicians face. We now understand that when nociception enters the central nervous system it is greatly influenced by excitatory and inhibitory mechanisms. As a result, we have come to appreciate that pain is not exclusive to one medical discipline. Instead, our patients deserve the best that every discipline can offer to reduce their suffering.

This textbook is an example of this progressive thinking as it combines input from three different professions with the idea of providing the best care for our patients. In acute injuries, physical therapy can provide the necessary management that assists in recovery. It is important to recognize that when pain becomes chronic, central factors become a predominant component of maintaining the pain. With these patients, a multiprofessional team adds an important dimension to patient recovery. This textbook offers information from well-known authorities in physical therapy, orofacial pain and clinical psychology, which will help the clinician better understand what each discipline can offer. This multiprofessional effort offers the best possible success for patient management. A text like this is rare and the authors should be commended for their combined work. This professional endeavor is a reflection of the evidence-based science and the state-of-the-art efforts our patients deserve. The information found in this text will help all clinicians better evaluate and manage their patients.

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The term temporomandibular disorder (TMD) encompasses pain in the head and face, a condition which can be highly distressing and disabling for the patient. As clinicians, we should focus our attention on the therapeutic approaches than can help those patients. It is increasingly clear that the value of manual therapy, exercise, and needling therapies can be understood through the emerging concepts of pain neuroscience, and that all these interventions come together in a biopsychosocial model. In fact, manual therapy and exercise is probably the therapeutic combination most commonly used by many health care professionals for treating patients with chronic pain. Today, it is universally accepted that the central nervous system plays a critical role in the personal experience and clinical presentation of pain, and that manual therapy, exercise or needling therapies trigger peripheral and central nervous system responses. It was against this background of a growth in understanding of mechanisms that we were inspired to bring together a wide range of contributors from all over the world to provide a comprehensive and practical account of the diverse approaches to assessing and treating TMDs.

In conceiving and editing this book we have adopted the evidence and clinically informed paradigm. We believe that a combination of evidence and clinical experience should guide all clinicians in the management of individuals with chronic pain. The main feature of the evidence-based paradigm is that diagnosis and management should be guided mainly by the best available scientific evidence; however, the relevance of this doctrine can be limited since there is no good evidence for all intervention or diagnostic procedures that therapists use in daily practice. Although evidence-based practice is in continuous evolution, the evidence-informed paradigm is considered more appropriate since the clinician takes the best available scientific evidence and combines it with clinical experience while bearing in mind the patient’s expectations and beliefs.

Throughout this textbook, chapter authors have integrated clinical experience and reasoning based on a neurophysiologic rationale with the most up-to-date evidence, thereby in effect combining the best of evidence-based and clinically based paradigms, mimicking what clinicians do in everyday clinical practice. We believe that this approach has created a textbook that truly provides practicing clinicians with what they need to know for real-life screening, diagnosis, and management of patients with TMD pain. This should be especially valuable since the multifactorial etiology and presentation that patients with TMD may exhibit can create a real challenge to the clinician.

The textbook is divided into four parts. In Part 1, several authors review the epidemiology and classification of TMD pain syndromes and the neuropsychological mechanisms underlying craniofacial pain. In Part 2, authors set out the steps for taking a comprehensive history in patients affected by TMD and the basic principles for the physical examination. In this section, authors clearly demonstrate the relevance of regional interdependence by showing why the thoracic and cervical spine should be also assessed in individuals suffering from TMD. The remaining parts cover therapeutic interventions for TMDs. Part 3 describes several manual therapy interventions, including joint, muscle, fascia, and neural interventions, and also therapeutic exercises. Finally, Part 4 covers other therapeutic options, including different needling therapies, by placing the field of these interventions within the context of contemporary pain neurosciences and neuroscience education.

We anticipate that this textbook will become the standard for manual management of individuals with TMDs and we hope that it will bridge apparent differences in opinion. We aim to unite different health care disciplines using manual therapy, exercise, and needling therapies as their therapeutic approach. We hope that the current textbook will ultimately benefit patients worldwide.

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loads (toward cranial, dorsal, or dorsocranial) can be applied (Figure 8.2). The application of overpressure will increase the compressive forces over the disc and TMJ stimulating the nociceptors and evidencing the presence of tissue irritability. Of particular relevance is the application of compressive forces to the retrodiscal tissue since it is highly sensitive to sustained compression (Langendoen et al., 1997). De Wijer et al. (1995) reported substantial ($k$: 0.60) interexaminer reliability for compression tests in individuals with TMD pain.

**Palpation of the temporomandibular joint**

Palpation of the TMJ is probably the most relevant clinical examination test (Sipilä et al., 2011). The prevalence of local-induced pain with palpation of the TMJ has been found to be 58 per cent in patients with post-traumatic stress disorder (Uhac et al., 2011) and 45 per cent in patients with rheumatoid arthritis (Witulski et al., 2014). Among these patients, the posterior pole of the TMJ was the most sensitive area in around 40 per cent of cases (Uhac et al., 2011; Witulski et al., 2014). In fact, the prevalence of induced pain with palpation on the posterior pole of the TMJ has increased its prevalence between 1993 and 2003 (Köhler et al., 2013). It is interesting to note that pain on palpation of the TMJ was significantly associated with TMD severity in a sample of elderly patients (Camacho et al., 2014).

An important topic for discussion with regard to manual palpation is how much pressure should be applied and for how long, particularly since the TMJ can be very sensitive in individuals with arthrogenous TMD (Benoliel & Sharav, 2009). Cunha et al. (2014) found 89.7 per cent specificity and 70 per cent sensitivity when 1.36 Kg/cm² pressure was applied during palpation of the TMJ. This value was considered to be the most appropriate threshold at which to diagnose moderate to severe TMJ arthralgia. How long the pressure should be maintained has not been determined.

The entire TMJ should be palpated to get an impression of the presence of joint inflammatory pain. One of the most expanded protocols for TMJ palpation has been described by Rocabado (personal

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**Figure 8.3**

Anatomical points for manual examination of TMJ irritability proposed by Rocabado. © Mariano Rocabado.
Figure 8.4
Palpation of the anteroinferior synovial pole (A); anterosuperior synovial pole (B); collateral TMJ ligament (C); posteroinferior synovial pole (D); and, posterosuperior synovial pole (E).
Clinical examination of the temporomandibular joint and masticatory muscles

communication; Figure 8.3). This protocol consists of palpation of five connective tissue structures and three manual maneuvers for testing the temporomandibular ligament, the inferior retrodiscal lamina, and the retrodiscal tissue. For palpation of the TMJ, the patient lies in supine with the head slightly turned to the opposite side. The mouth is slightly opened (10 mm) and slightly protruded. From that position, the clinician can palpate the anteroinferior synovial pole (Figure 8.4A), the anterosuperior synovial pole (Figure 8.4B), the collateral TMJ ligament (Figure 8.4C); the posteroinferior synovial pole (Figure 8.4D), and the posterosuperior synovial pole (Figure 8.4E) of the TMJ.

Since the temporomandibular ligament has dense connective tissue (Cuccia et al., 2011), it needs a manual maneuver to assess its irritability. The clinician places the thumb of the first hand on top of the last upper mandibular molars and the index finger on the inferior portion of the mandible. The other hand stabilizes the patient’s head and the index and middle fingers palpate the ligament (see Figure 11.7). From that position, the clinician applies an inferior and posterior force through the thumb (Figure 8.5).

The retrodiscal tissue attaches to the disc posteriorly and is divided into two laminae: the superior lamina which is attached to the squamotympanic fissure of the temporalis bone and is composed of fibroelastic tissue; and the inferior lamina, which is attached to the back of the mandible condyle and is composed of nonelastic, rigid collagen fibers. The region between both laminae contains highly vascular and neural tissue (Langendoen et al., 1997). The posterior part of the TMJ and the retrodiscal tissue receive an extensive innervation from free nerve endings (Langendoen et al., 1997). It has been observed that the retrodiscal tissue signal intensity is higher in abnormal TMJs, suggesting an increased vascularity in the tissue (Lee & Yoon 2009). Therefore, examination of the retrodiscal tissue consists of two maneuvers. First, the inferior retrodiscal lamina is assessed. With one hand the same position as used for the temporomandibular ligament (Figure 8.5) but with the other hand placed at the angle of the mandible, a posterior and superior (compressive) force through the thumb should be applied by the clinician (Figure 8.6). To assess the retrodiscal tissue, a posterior, superior, and finally an anterior force through the thumb is applied by the clinician (Figure 8.7).
Dynamic techniques, such as compression and contraction, may also be applied to the masseter. This technique combines a manual compression with an active contraction of the compressed muscle (Gröbli & Dejung, 2003). For the masseter, manual compression is applied over the TrP and the patient is asked to clench the teeth (Figure 12.6). A dynamic longitudinal or transverse stroke is also applied. For this technique, the clinician applies longitudinal or transverse strokes over the TrP taut band with both thumbs from a cranial (zygomatic) to caudal (mandible) direction and at the same time the patient opens the mouth (Figure 12.7).

Manual therapy for the medial pterygoid muscle

The medial pterygoid is the main agonist of the masseter during mouth closing with the temporalis. The referred pain elicited by TrPs in this muscle is perceived inside the TMJ, ear, and some parts of the mouth (Simons et al., 1999). This muscle is difficult to access with manual palpation, but the lower part can be reached at the inferior border of the mandible angle. In this anatomical area, a static compression is applied with two fingers (Figure 12.8). For the middle part, intraoral contact is needed. The patient opens the mouth and the clinician’s index finger contacts
Manual therapy for myofascial trigger points in temporomandibular disorders

the middle part of the medial pterygoid between the dental arcades (Figure 12.9). In this position, a static compression is applied (Figure 12.10).

Manual therapy for the lateral pterygoid muscle

The lateral pterygoid is an important muscle for movement and control of the jaw since it is anatomically attached to the TMJ disc, particularly the superior head (Usui et al., 2008). TrPs in the lateral pterygoid may refer pain in and around the maxillary sinus and deep into the TMJ (Simons et al., 1999). Manual palpation of the lateral pterygoid is a controversial issue due to its anatomical location (Turp & Minagi, 2001). A recent study has confirmed that palpation of the anterior area of the muscle is feasible (Stelzenmueller et al., 2016). The lateral
The lateral pterygoid can be palpated using intraoral contact in the cheek. The index finger of the clinician palpates along the oral vestibule parallel to the upper section of the alveolar process of the maxilla, onto the maxillary tuberosity, until the lateral plate of the pterygoid process is reached (Figure 12.11). In this position, a manual compression is applied (Figure 12.12). A stretching compression technique combining compression with an active stretching of the muscle can also be applied. From the same palpation position, the patient can be asked to perform active mandible retraction, which will stretch the lateral pterygoid.

Manual therapy for the suprahyoid muscles

The anterior neck muscles, particularly the suprahyoid musculature, participate in the overall stability of the cervical spine, provide support for swallowing, and are involved in mastication. In general, TrPs in the suprahyoid muscle contribute to pain in multiple areas including the anterior neck, larynx, tongue, and lower facial area. The digastric muscle is probably the muscle most accessible for palpation and is therefore the main target of our techniques. A direct compression technique may be applied to the anterior (Figure 12.13) or posterior (Figure 12.14) belly of the muscle. Care should be taken when palpating the posterior belly as it is a highly sensitive anatomical area. When the sensitivity has decreased, dynamic transverse strokes may be applied to the suprahyoid musculature. For this technique, the clinician contacts bilaterally with both digastric muscles and applies strokes over the inferior border of the mandible (transverse strokes in relation to the anatomical attachments of the suprahyoid muscles) (Figure 12.15).
Myofascial induction approaches in temporomandibular disorders

Figure 13.6
Cervical fascia distribution.

Figure 13.7
The superficial fascia in the cervical, pectoral and brachial areas. Note the continuity of its structure and the high fat content.

Figure 13.8
The deep fascia in the cervical, pectoral and brachial areas. Note the continuity of its structure and fibrous appearance.
B. Pterygoid fascia induction

The clinician places the index finger (of his dominant hand) above the third molar in the pterygoid fossa. The index, middle and ring fingers of the other hand contact the temporomaxillary region (Figure 13.21). The pressure must be exerted in all directions in a consecutive manner until relaxation is perceived. Special care must be taken because this area is usually extremely sensitive.

C. Masseter fascia induction

The clinician places the tips of the middle and ring fingers of both hands symmetrically over the insertion point of the masseter in the zygomatic arch on each side (Figure 13.22). Subsequently, he