

Fourth Edition

Manual of Temporomandibular Disorders

Edward F. Wright | Gary D. Klasser



WILEY Blackwell

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We dedicate this book to our spouses and families, who unconditionally and unselfishly gave of themselves so that we could devote our time and energy on this book, and to all the individuals, past and present, who are advancing our scientific knowledge in the study of TMD.

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Preface

We are both temporomandibular disorder (TMD) educators and clinicians with additional training in TMD. As educators we strive to provide our students with an education on various subjects that will prepare them to deliver appropriate care to their patients upon graduation. As clinicians we aim to provide our patients with quality care based upon sound scientific principles. When we were educating our students about TMD we discovered a common concern among our predoctoral students and post-graduate residents. Both groups lamented they were lacking a concise, clinically relevant, evidence-based TMD book. Specifically, they wished for a book (i) written on the level for the average dentist or dental student/resident, (ii) focused on evidence-based diagnosis and multidisciplinary management for the majority of TMD patients, (iii) that included guidelines on how to rule out disorders that mimic TMD and identify medical contributing factors for which patients may need to be referred, (iv) that detailed how to identify patients with complex TMD who are beyond the scope of most dentists, and (v) that focused on means and ways they could provide their patients with evidence-based management strategies and interventions.

Therefore, we decided to produce a book to satisfy their needs as well as to the needs of general dental practitioners who wish to learn more about TMD. As such, we decided to assimilate our academic and clinical evidence-based TMD knowledge and experiences to produce such a book. This book attempts to simplify the complexities of

TMD for ease of clinical understanding and application, in addition to integrating the current scientific literature, clinical trials, and clinical experiences into an effective strategy. To the degree possible, it provides a systematic guide on how to most effectively diagnose and manage the various types of TMD patients. The book directs how the information obtained from the patient interview and clinical exam can be used to select the most cost-effective, evidence-based management approaches that have the greatest potential to provide long-term symptom relief.

Those who choose to manage TMD patients must not only consider the musculoskeletal factors but also the psychosocial and neurophysiology issues related to the management of TMD. Since most readers of this text are not trained to be TMD “specialists,” the most easily understandable mechanisms that correlate to the recommended management approaches have been chosen. Occasionally, when simplified mechanisms will not sufficiently explain the phenomenon, other considerations such as psychosocial and CNS involvement are discussed. Similarly, since this is not a comprehensive reference book on TMD, it periodically warns that certain characteristics are suggestive of an uncommon disorder beyond the book’s scope and recommends the reader consider referring the patient to a more knowledgeable and experienced practitioner.

To enhance the educational experience for the reader, we have provided questions that

we frequently receive at the beginning of the applicable chapters, and important concepts are highlighted throughout the book. Important terms are in bold, with many listed in the glossary.

We are proud to state this is the fourth edition of this book. The material contained herein has certainly been expanded and enhanced from the various previous editions as we have embraced the explosion

of scientific knowledge in this particular field of dentistry. We sincerely hope this easily-read textbook will be used to facilitate your TMD evaluations and therapies and ultimately assist you in providing your patients with the best scientifically-based care possible.

Edward F. Wright
Gary D. Klasser

About the Companion Website

Don't forget to visit the companion website for this book:

www.wiley.com/go/wright/manual



There you will find valuable material designed to enhance your learning, including:

- Patient Handouts
- Examples
- Additional TMD Information

Scan this QR code to visit the companion website



Introduction

The cardinal signs and symptoms for temporomandibular disorder (TMD) are pain in the masseter muscle, temporomandibular joint (TMJ), and/or temporalis muscle regions; mouth-opening limitation; and TMJ sounds. TMD pain is by far the most common reason patients seek care [1, 2].

✘ Focal Point

The cardinal signs and symptoms for TMD are pain in the masseter muscle, TMJ, and/or temporalis muscle regions; mouth-opening limitation; and TMJ sounds.

TMD is the second most common musculoskeletal pain, with low back pain being the first. It is most often reported in individuals between the ages of 20 and 40. Approximately 33% of the population has at least one TMD symptom, and 3.6–7% of the population has TMD with sufficient severity to cause patients to seek care [2–5].

✘ Focal Point

TMD is an extremely common disorder that is most often reported in individuals between the ages of 20 and 40. Approximately 33% of the population has at least one TMD symptom, and 3.6–7% has TMD with sufficient severity that care is desired.

TMD symptoms generally fluctuate over time and correlate significantly with masticatory muscle tension, tooth clenching, grinding,

and other **oral parafunctional behaviors**. TMD symptoms are also significantly associated with an increase in psychosocial factors, for example, worry, stress, irritation, frustration, and depression [6–8]. Furthermore, TMD patients with poor psychosocial adaptation have significantly greater symptom improvement when the dentist's TMD therapy is combined with cognitive-behavioral intervention [2, 9].

◎ Quick Consult

Observing TMD Symptom Correlations

TMD symptoms generally fluctuate over time and correlate significantly with masticatory muscle tension, tooth clenching, grinding, and other oral parafunctional behaviors. TMD symptoms are also significantly associated with an increase in psychosocial factors, for example, worry, stress, irritation, frustration, and depression.

TMD can cause other symptoms that are beyond the masticatory musculoskeletal system, for example, tooth pain, nonotologic otalgia (ear pain that is not caused by the ear), dizziness, tinnitus, and neck pain. TMD can contribute to migraine and tension headaches, muscle pain in the region, and many other pain complaints [10].

Women request therapy more often than do men, providing a female–male patient ratio between 3:1 and 9:1 [2]. Additionally, TMD symptoms are less likely to resolve for

women than for men [6, 7]. Many hypotheses attempt to account for the gender difference, but the underlying reason remains unclear [11].

Quick Consult

Comparing the Response of Men and Women

TMD symptoms are less likely to resolve for women than for men.

Knowledge about TMD has grown throughout the ages. In general, management philosophies have evolved from a mechanistic dental approach to a biopsychosocial medical model with the integration of neuroscience literature. This is comparable to the management philosophies of other joint and muscle conditions in the body [3, 12, 13].

Beneficial occlusal appliance therapy and TMJ disc-recapturing surgery were reported as early as the 1800s [12, 14]. The understanding of the importance to harmonize the occlusion for the health of the masticatory muscles and TMJs developed as the skills to reconstruct natural teeth advanced. As enthusiasm grew for obtaining optimum health, comfort, and function, the popularity of equilibrating the natural dentition also developed [12, 15].

In the 1930s, Dr. James Costen, an otolaryngologist, brought TMD into the awareness of physicians and dentists, and readers may still find TMD occasionally referred to as **Costen's syndrome**. Dr. Costen reported that TMD pain and secondary otologic symptoms could be reduced with alterations of the occlusion [16].

Since TMD is a multifactorial disorder (having many etiologic factors), many therapies have a positive impact on any one patient's symptoms. Throughout much of the 1900s, many beneficial therapies were independently identified. Physicians, physical therapists, chiropractors, massage therapists, and others treating the muscles and/or cervical region reported positive responses in treating TMD symptoms. Psychologists

working with relaxation, stress management, cognitive-behavioral therapy, and other psychological aspects reported beneficial effects with their therapies. Orthodontists, prosthodontists, and general dentists working with the occlusion also observed the positive impact that occlusal changes provided for TMD symptoms.

Focal Point

Since TMD is a multifactorial disorder (having many etiologic factors), many therapies have a positive impact on any one patient's symptoms.

Surgeons reported positive benefits from many different TMJ surgical approaches. Many forms of occlusal appliance were tried and advocated, from which studies reveal there is similar efficacy for different appliance forms. Medications as well as self-management strategies used for other muscles and joints in the body were also shown to improve TMD symptoms. During this observational period, TMD therapies were primarily based on testimonials and clinical opinions, according to a practitioner's favorite causation hypothesis rather than scientific studies [12].

Different philosophies appeared, with enthusiastic nonsurgeons "recapturing" discs through occlusal appliances, whereas surgeons repositioned the discs or replaced discs with autoplasmic materials. The eventual breakdown of the autoplasmic materials led to heartbreaking sequelae that caused many to step back from their narrowly focused treatment regimens and recognize the multifactorial nature of TMD and the importance of conservative noninvasive evidence-based therapies [12].

Over the last 50 years, much was learned about basic pain mechanisms and the shared neuron pool of the trigeminal spinal nucleus, other cranial nerves, and cervical nerves. This provided a better understanding of the influence that regional and widespread pain may have on TMD, the similarities between

chronic TMD pain and other chronic pain disorders, and the need for chronic pain management from a psychosocial and behavioral standpoint [8, 17].

Today, a large number of potentially reversible conservative therapies are available for our TMD patients. By using the information obtained from the recommended patient interview and clinical exam, practitioners can select cost-effective, evidence-based therapies that have the greatest potential to provide long-term symptom relief. The management selected often reduces a patient's **contributing factors** and facilitates the patient's natural healing capacity. This management is consistent with therapies of other orthopedic and rheumatologic disorders [2, 3, 10, 13].

Quick Consult

Selecting TMD Therapies

Today, a large number of potentially reversible conservative therapies are available for our TMD patients.

We do not fully understand TMD and the mechanisms causing or sustaining it. Practitioners should bear in mind that not all TMD therapies are equally effective, and no one therapy has been shown to be best for all TMD patients. Most TMD patients can be

Focal Point

By using the information obtained from the patient interview and clinical exam, practitioners can select cost-effective, evidence-based therapies that have the greatest potential to provide long-term symptom relief for patients. The therapies selected often reduce a patient's contributing factors and facilitate the patient's natural healing capacity.

managed successfully with reversible, conservative, noninvasive therapies by general practitioners, without using expensive, high-tech therapies [4, 18–20].

Most TMD patients who receive therapy obtain significant symptom relief, whereas patients who do not receive therapy have minimal symptom change [21].

TMD therapy is generally recommended for patients who have significant temporal headaches, preauricular pain, masseter muscle pain, TMJ catching or locking, loud TMJ noises, restricted opening, difficulty eating due to TMD, or nonotologic otalgia due to TMD.

To help your hygienists better identify patients in your practice who need your help, a recommended “Referral Criteria for Hygienists” is available on the book's website.

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Part I

Initial Evaluation

Temporomandibular disorder (TMD) generally involves many structures with varying degrees of pain intensity and dysfunction. During the initial evaluation, the involved structures need to be identified and the degree to which each contributes to the patient's symptoms need to be categorized. Additionally, the contributing factors and symptom patterns help to identify which therapies will be the most beneficial for each patient [1].

Hence, the goals of the initial examination are to identify: a patient's primary diagnosis; secondary, tertiary, and so on, diagnoses; contributing factors; and symptom patterns.

⊗ Focal Point

The goals of the initial examination are to identify: a patient's primary diagnosis; secondary, tertiary, and so on, diagnoses; contributing factors; and symptom patterns.

The **primary diagnosis** is the diagnosis for the disorder most responsible for a patient's chief complaint. This diagnosis can be of TMD origin (e.g. myalgia, TMJ arthralgia, or temporomandibular joint [TMJ] disc displacement without reduction with limited opening) or from a different source (e.g. pulpitis, sinusitis, or cervicogenic headache) [2].

⊗ Focal Point

The primary diagnosis is the diagnosis for the disorder most responsible for a patient's chief complaint.

Secondary diagnosis, tertiary diagnosis, and so on, are other TMD diagnoses that generally contribute to the TMD symptoms. Typically, the primary diagnosis will be of TMD origin (e.g. myalgia), and the secondary and tertiary diagnoses will be other TMD diagnoses (e.g. TMJ arthralgia and TMJ disc displacement with reduction) that contribute to a patient's chief complaint. When a non-TMD (e.g. fibromyalgia) contributes to a TMD primary diagnosis, the non-TMD disorder is designated as a contributing factor to the TMD diagnosis and not as secondary or tertiary diagnosis [2].

⊗ Focal Point

Secondary, tertiary, and so on, diagnoses are additional TMD diagnoses that contribute to the TMD symptoms.

During the initial exam, we also attempt to identify the **perpetuating contributing factors**. These are elements that perpetuate the disorder (not allowing it to resolve), for

example, sleep parafunctional behaviors, gum chewing, awake clenching, stress, or neck pain [1–3]. Additionally, we attempt to identify the **symptom patterns** that include the period of the day in which the symptoms occur or are most intense (e.g. worse upon awaking) and the location pattern (e.g. begins in the neck and then moves to the jaw).

Focal Point

Perpetuating contributing factors are elements that are not allowing the disorder to resolve, for example, sleep parafunctional behaviors, gum chewing, awake clenching, stress, or poor posture.

Symptom patterns include the period of the day in which the symptoms occur or are most intense (e.g. worse upon awaking) and the location pattern (e.g. begins in the neck and then moves to the jaw).

The following non-TMD examples may help you better understand how these terms are used. A patient complains to her physician about wrist pain. Through palpation of her wrist area, her physician determines the primary cause for her pain is the tenderness within the wrist joint (its diagnosis would be the primary diagnosis). Her physician also finds the muscles around the wrist are painful but less tender than the wrist joint (the muscle diagnosis would be the secondary diagnosis). The physician also knows the patient has a systemic arthritic condition, which he suspects makes her more susceptible to developing the wrist pain (a contributing factor).

By asking questions, the physician finds that this pain only occurs upon awakening and lasts half an hour; this suggests that wrist activity occurring during sleep is the major contributing factor. Her physician may decide the best initial therapy is to prescribe her a wrist splint to wear during sleep to ensure the wrist stays in a neutral position.

In a second example, the patient has the identical diagnosis and a systemic arthritic

condition but has a different symptom pattern. In this example, the wrist pain consistently begins approximately half an hour after she starts using the computer and continues as long as she uses the computer, suggesting that computer use is the major contributing factor for her wrist pain.

To treat the wrist pain, her physician decides the best initial approach is to (i) refer her to a therapist to teach her about computer keyboard and mouse ergonomics, and (ii) prescribe her a nonsteroidal anti-inflammatory drug (NSAID) short term, to provide her with temporary pain relief until her wrist responds to the computer keyboard and mouse ergonomic instructions. In both situations, the physician decides to not escalate therapy for the systemic arthritic condition because he believes the local therapies will resolve the pain complaint.

In spite of having the identical diagnoses and systemic contributor, the preferred therapy changed with different contributing factors.

The initial TMD evaluation involves interviewing the patient about his or her symptoms, potential contributing factors, and potential non-TMD. The interview most influences the patient's final management approach and generally brings to light concerns that the practitioner will need to evaluate during the clinical examination.

The clinical examination will help to confirm or rule out the structures involved in the patient's complaints and other suspected disorders that may contribute to these complaints. Imaging may be appropriate, but, in our experience, it rarely changes the management approach derived from the patient interview and examination.

In the late 1980s when one of the authors was in the U.S. Air Force, an experience demonstrated that patients with TMD symptoms needed a more thorough evaluation for potential non-TMD than what most dentists provided. A physician asked if he knew that one of the dentists who worked for him had diagnosed someone with TMD when the patient actually had meningitis. After reviewing the

patient's dental record, he found that she had been referred by the emergency room physician for possible TMD. The patient told the dentist she had been previously diagnosed with TMD, had an occlusal appliance, and believed she was having a relapse of this disorder. The dentist palpated her masticatory muscles and TMJs and found that the muscles were tight and tender to palpation. The dentist confirmed for the patient that she had TMD, gave her TMD self-management instructions, and told her she should see her civilian dentist to have her appliance adjusted (as she was not an active-duty military patient). At the time, it appeared to him the dentist performed an appropriate evaluation and provided an accurate diagnosis.

The emergency room record was then reviewed to obtain a better perspective of what had transpired. It was documented that the patient also told the emergency room physician that she had previously been diagnosed with TMD, had an occlusal appliance, and believed she was having a relapse of this disorder. The physician found that she had firm masticatory and cervical muscles and a fever, and referred her to the dentist for a TMD evaluation and to a neurologist. When the patient saw the neurologist, he did a spinal tap and found that she had meningitis.

This disheartening experience inspired him to research everything he could concerning disorders that mimic TMD. Lists were made of how their symptoms differed from TMD and a fairly brief list of questions was finally formulated that dentists can use to warn themselves that a patient may have a non-TMD condition that is mimicking TMD [4]. This questionnaire has been used ever since and modified as new information became available [5–7]. This questionnaire is certainly not foolproof, but it is the best this

author can formulate to alert him of potential non-TMD disorders, contributing factors, and symptom patterns.

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1

Patient Interview

FAQs

- Q** What should be done if a patient reports having a temporomandibular joint (TMJ) Teflon-Proplast implant, Silastic implant, or TMJ prostheses?
- A** A specific protocol has been recommended for TMJ Teflon-Proplast and Silastic implants and joint prostheses [1]. Follow-up for these is beyond the scope of this book. If the practitioner is unsure of the implant or prosthesis type and management, it is recommended that the practitioner refer the patient to, or work in conjunction with, someone who has greater expertise in this area.
- Q** What are the different situations in which you recommend I refer a patient to someone who has greater expertise in this area?
- A** Table 1.4 provides a list of histories and symptoms that would be identified during the patient interview, for which most general dentists would refer a patient to a practitioner with greater expertise. Table 3.4 provides additional characteristics that would be identified during the clinical exam, for which most general dentists would refer a patient to a practitioner with greater expertise.
- Q** What is secondary gain and how common is it among temporomandibular disorder (TMD) patients?
- A** Secondary gain is a situation in which the patient is rewarded for having TMD; for example, the patient receives disability payments or is excused from undesirable chores or work. Clinically, this is not commonly observed among TMD patients, but, if it is present, the patient may not relate improvement from any therapy.
- Q** What should be done when a patient appears to have a tooth causing or contributing to the TMD symptoms?
- A** The symptoms that suggest that a tooth is causing or contributing to the TMD symptoms are provided in Items 9 and 10 in Chapter 2, and a recommended approach to determine whether the tooth is causing or contributing to a patient's TMD symptoms is provided in "Intraoral Examination" in Chapter 3.
- A recommended "Initial Patient Questionnaire" is available on the book's website and may be reproduced or printed for your patients to complete. The questionnaire is designed to efficiently use the time spent interviewing patients. The practitioner's customary medical

history form should be used in conjunction with this questionnaire.

Quick Consult

Collecting Symptom History

The “Initial Patient Questionnaire” is designed to efficiently use the time spent interviewing patients and should be used in conjunction with the practitioner’s customary medical history form.

The practitioner may wish to add an additional page to obtain medical and dental insurance information and the name and address of the individual who recommended that the patient come to your office, in addition to the name and address of the patient’s physician and dentist. It is comforting to a referring provider to receive a letter acknowledging that the referral was appropriate and providing your findings and recommended management. This also tends to encourage the referring provider to recommend your office the next time a patient with a similar complaint needs to be managed. A copy of this letter is often sent to the patient’s physician and dentist (if not the referring doctor); a release statement is included in the “Initial Patient Questionnaire” for this purpose.

The questionnaire appears to keep patients from elaborating in nonproductive discussions or becoming irritated by the number of questions asked, and prevents the practitioner from forgetting to ask relevant information. Clinical experience suggests that a patient’s responses are not always accurate, and the examiner needs to review the answers with the patient. For better patient recall, it appears best if the patient arrives 15 minutes prior to the appointment and completes the questionnaire just prior to the appointment. During the patient interview, the practitioner usually needs to ask the patient to elaborate on some of the answers.

Quick Consult

Confirming Patient Responses

Clinical experience suggests that a patient’s responses are not always accurate, and the examiner needs to review the answers with the patient.

Technical Tip

Assisting Patient Recall

For better patient recall, it appears best if the patient arrives 15 minutes prior to the appointment and completes the questionnaire just prior to the appointment.

Chapter 2, “Review of the ‘Initial Patient Questionnaire,’” presents the key points for each of the questions and is designed to help a practitioner quickly evaluate a patient’s responses. Many of the questions are self-explanatory, but additional discussion for some of the questions, as well as supplementary information, is provided as follows:

Item 1 (On the diagram below, please shade the areas of your pain:) provides a quick overview of the patient’s pain locations. From the patient’s shaded areas, we observe whether the patient’s pain appears to be from (i) the masseter muscle or TMJ (the most common TMD pain locations); (ii) the posterior neck region and locations where neck pain commonly causes referred pain (e.g. periorbital, forehead, and temporalis regions [2, 3]); (iii) the anterior neck region, in which we will attempt to identify whether this is due to a local problem or referred pain (6% of patients with cardiac ischemia only have craniofacial pain, and the anterior neck region is the most common location for referred ischemia pain to appear among these patients [4–8]); or (iv) other types of pain patterns (e.g. sinus pain).

Items 4 and 5 (What makes it feel worse? and What makes it feel better?) provide

insight as to whether the patient's symptoms are due to TMD. One study found that 99% of TMD patients reported their pain was modified by movement, function, parafunctional activity, and/or rest. Intuitively, one would expect movement, function, and parafunctional activity to worsen TMD pain, while rest would improve TMD pain. This is a very powerful way to try to identify patients whose pain is and is not due to TMD. Contrarily, 9% related at least one aspect of their pain was improved by a specific movement; for example, occasionally TMD patients tell us that chewing gum, popping the TMJ, and so on, improve their TMD pain [9].

Item 6 (What treatments have you received?), with additional inquiries, gives an indication of which interventions were previously beneficial for the patient. For example, if the patient found that an occlusal appliance (which the patient no longer has) resolved the symptoms, then fabricating another appliance should be very beneficial. Reinforce to the patient that using the intervention (e.g. application of heat) he or she previously found beneficial can again be beneficial. If the patient has previously received the therapies the practitioner traditionally provides but without satisfactory benefit, the practitioner may consider a review of their initial diagnosis, alter management strategy, or refer the patient to someone with greater expertise in this area.

TMJ implants composed of Teflon-Proplast and Silastic have a history of fragmenting, causing a foreign-body response that results in progressive degeneration of the condyle and glenoid fossa. A specific protocol has been recommended for these implants and joint prostheses [1]. Follow-up for these is beyond the scope of this book. If a practitioner is unsure of the implant or prosthesis type and management, it is recommended that the practitioner refer the patient to, or work in conjunction with, someone who has greater expertise in this area.

Item 7 (When is your pain the worst?) will often help identify the time when significant contributing factors are present. Patients

with sleep parafunctional behaviors usually have an increase in pain when they first awake, whereas patients with awake parafunctional behaviors have an increase in pain during the day or evening. The practitioner may be able to elicit more specific periods, for example, during or after driving, or when using the computer.

⊗ Focal Point

Patients with sleep parafunctional behaviors usually have an increase in pain when they first awake, whereas patients with awake parafunctional behaviors have an increase in pain during the day or evening.

⊙ Quick Consult

Observing for Significant Contributing Factors

When discussing a patient's symptom pattern, a practitioner may be able to elicit specific periods when significant contributing factors are present, for example, during or after driving, or when using the computer.

Item 8 (What does the pain keep you from doing?) gives the practitioner a sense for how much the pain is affecting the patient's life. This may correlate with how motivated the patient will be to participate in therapy and the level of therapy the patient may be interested in receiving. Occasionally, this answer is out of proportion with other features of the examination; for example, the patient is unable to work, but has only minimal palpation tenderness. Additional questions may reveal the patient continues to participate in other activities, such as yelling at basketball games. This inconsistency may suggest that other factors are involved, commonly referred to as **secondary gain** [10].

Item 9 (Is your pain...) helps identify some possible conditions for a patient's pain.

Patients most commonly characterize TMD pain as having an ache, pressure, or dull pain quality. If throbbing is one of the components, generally, the patient's disorder falls within one or more of the following three situations:

First, some patients report their pain is an ache, pressure, or of dull quality and, when it worsens, its quality may change to throbbing. The patient may have nausea, photophobia, and/or phonophobia associated with the throbbing pain. For these patients, clinically it appears that, if the ache, pressure, or dull pain can be satisfactorily reduced, this can prevent the pain sequence from escalating to the throbbing level.

Quick Consult

Reducing Throbbing Pain

Clinically, it appears that if a patient relates the ache, pressure, or dull pain worsens to throbbing and can be satisfactorily reduced, this prevents the pain from escalating to the throbbing level.

In a second situation, the patient does not report that an ache, pressure, or dull pain progresses into throbbing pain. The source of the two types of pain may be from different sources, and the throbbing pain may not respond to TMD therapy. In this situation, the practitioner may wish to perform an occlusal appliance therapy trial and, if it is not effective, consider a referral to the patient's physician or neurologist for a probable neurovascular condition often diagnosed as migraine. Studies suggest that some migraines respond to TMD therapy, but characteristics for identifying which migraines respond are not well established [11, 12].

For other patients, the throbbing pain may be **referred pain** from an oral problem (most commonly a tooth). Sometimes the perceived painful **site** (e.g. masseter muscle and/or

TMJ) appears as the **source** to the patient, whereas the actual source (e.g. a tooth) has minimal symptoms. This is similar to how a patient suffering from a heart attack may perceive pain only in the left arm, whereas the pain's source is the heart. Management for the pain must be directed toward the source, not the site where it is felt.

Quick Consult

Observing for Throbbing Pain Sources

Throbbing pain may be referred pain from a pulpitis.

Innervations from tooth pulps and the masticatory musculoskeletal system appear to travel along similar pathways, so pain from one can sensitize common areas within the CNS, causing the pain to be perceived as from the other. There are also more nerves that enter the CNS than there are neurons to transfer the information to higher CNS centers, requiring pain input to **converge** from multiple sources (Figure 1.1). This may also cause pain from one source to be perceived as from the other. Additionally, muscles often respond to pain in the region by tightening, increasing the TMJ loading, causing pain in the masticatory muscles as well as the TMJ. Clinically, this sequence of events may manifest as a masticatory muscle or the TMJ being perceived as the source of the odontogenic pain, and upon palpating the tender structure identified as the pain's site, the patient relates this reproduced or intensified pain as the chief complaint.

A study of patients suspected of having TMD by their dentists, but whose TMD pain upon additional examination was found primarily to be referred odontogenic pain, reported that (i) none of the periapical radiographs revealed apical pathosis, and (ii) patients related that palpating the perceived painful site often reproduced their pain [13].