



The Diagnosis of Temporomandibular Disorders Leading to Surgical Intervention

2

Vincent E. DiFabio

Abstract

The ability to make a “clinical diagnosis” for temporomandibular disorders and advance to the conclusion that there is the medical necessity for a surgical correction is not an easy task. This involves many potential avenues and modalities. These would include years of clinical and/or surgical experience, a complete clinical medical and dental evaluation and examination, elimination of minor and major overlapping maladies, undergoing conservative nonsurgical care for a period of time when medically indicated, obtaining specific imaging of the hard and soft tissues of the TMJ area, using the Wilkes Classification when appropriate for internal derangements of the TMJ, and following good, sensible medical and dental ethical practices to assure that the patient comes first. Using the correct “clinical diagnosis” when medically indicated can point us to a surgical correction at a future date.

2.1 Introduction

The ability to make a “clinical diagnosis” for temporomandibular disorders and advance to the conclusion that there is the medical necessity for a surgical correction is not an easy task. This involves many potential avenues and modalities. These would

V. E. DiFabio (✉)

Oral and Maxillofacial Surgery, University of Maryland School of Dentistry,
Baltimore, MD, USA

Monocacy Health Partners Dental Clinic, Frederick, MD, USA

Private Practice of Oral and Maxillofacial Surgery, Frederick, MD, USA

Private Practice of Oral and Maxillofacial Surgery, Washington, DC, USA

e-mail: drdifabio@erols.com

© Springer Nature Switzerland AG 2019

S. T. Connolly et al. (eds.), *Contemporary Management of Temporomandibular Disorders*, https://doi.org/10.1007/978-3-319-99909-8_2

include years of clinical and/or surgical experience, a complete clinical medical and dental evaluation and examination, elimination of minor and major overlapping maladies, undergoing conservative nonsurgical care for a period of time when medically indicated, obtaining specific imaging of the hard and soft tissues of the TMJ area, using the Wilkes Classification when appropriate for internal derangements of the TMJ, and following good, sensible medical and dental ethical practices to assure that the patient comes first. Using the correct “clinical diagnosis” when medically indicated can point us to a surgical correction at a future date.

To make the correct “clinical diagnosis,” you will still need to be flexible and able to juggle multiple problems in the air at one time. These problems relate to initial presenting problems, associated problems, and disorders that encompass many symptoms, signs, pathologies, and other related associated issues that the patient brings to the consultation table. To reduce this voluminous amount of data to specific entities that will lead us to a surgical solution means that we start at a point in time when some or most of the “other problems” have been excluded and eliminated from consideration. That would be ideal but that usually does not happen in real life. These “other problems” would fall under the preview of the general dentist, physical therapist, primary care physician, and many, many others. Unfortunately, the real “clinical diagnosis” may be missed, and there can still remain the overriding problem of “overlap” in most, if not all, of these cases. It is this “overlap” that can cause difficulty in picking the correct course or courses of action to be followed. This is true even in the initial stage of diagnosis by some that do not see surgery as a solution and hence will try many splints, therapies, and medications to “try” to affect a treatment that is helpful to the patient. The difficulty is that most of the time these treatments are only partially successful, and this is owed to the overlap of the problems, diagnosis, and hence treatments offered as we shall see. The title statement above for this chapter, “Diagnosis of Temporomandibular Disorders Leading to Surgical Correction,” has been chosen specifically so that we can move to a “surgical” approach when this approach is indicated, medically necessary, and in the best interest of the patient. The thrust of this chapter is how to make the correct “clinical diagnosis” and how, when medically necessary, to propose a “surgical correction” to the patient and thus obtain the “final diagnosis.”

2.2 In the Beginning

All medical, surgical, and dental conditions have a beginning or presenting “problem(s)” commonly called the “chief complaint” (CC) and will be defined in the history of present illness. There may be more than one chief complaints or additional “problems” to consider, and thus the plural is used frequently in the more complicated cases, such as TMJ patients. It is from these presenting “problem(s)” that we can learn more about the “diagnosis” and hence the proper “treatment” of that problem. We address the “presenting problem(s)” in the TMJ area as we would for any other illness, disease, or pathology. We ask the patient to state why they are here in our office to see us, and then we listen to their answers. This can also be performed via forms that the patient fills out. There are many forms of paperwork

out there, and we would suggest that these forms comply with being short and not complicated. What is the chief complaint (CC) of the patient? We want to know the reason why they are here and not at a neurologist or primary care physician. We ask about other issues related to their CC. Is there other signs or symptoms that accompany the CC? Are there problems in other related areas? As we go forward, we will see how these “other problems” can be related or not related to the CC and perhaps show the way to the correct “clinical diagnosis.”

2.2.1 The Comprehensive Consultation

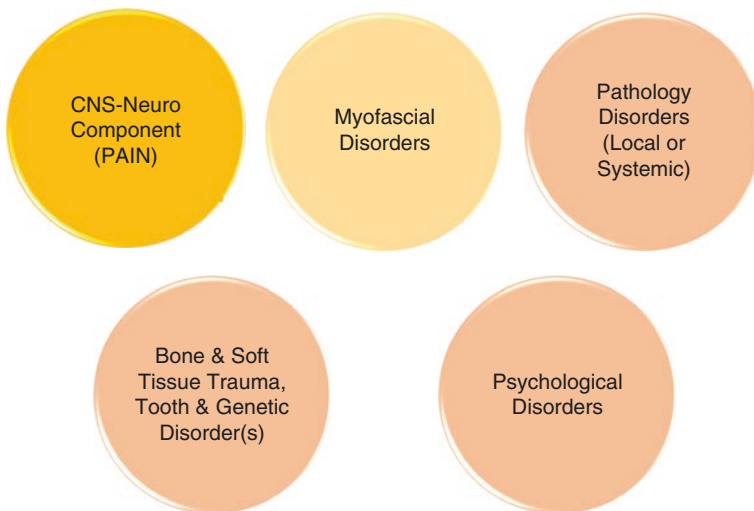
The first approach to defining the problem(s) is to accurately find the problem(s) and then accurately make the correct diagnosis. This sounds easy but not so fast! To accomplish this we will need to perform an evaluation and examination of the patient and thus come up with a management or treatment plan. This evaluation and examination of the patient falls under the heading of what is called in medicine or dentistry a comprehensive consultation. We use the medical model as it is more detailed and exacting in description. Using the American Medical Association’s Current Physician Terminology (CPT), this evaluation and examination will be at a level 4 or 5 (99244 or 99245). This evaluation and examination will take about 60–80 min and will include many issues and steps. It will involve gathering medical and dental information (past medical history and past dental history, a physical evaluation of the patient) and obtaining old records from other treating providers and obtaining new radiographs and any laboratory information that may be needed from the past medical history information. Because of the potential for overlap with other modalities, this aspect of “problem” will require a stealth inquiry into these problems to lead to the “correct diagnosis” and hence to the proposed proper treatment.

Typically, in a consultation for TMJ disorders, as there is not a specific model or template for TMJ disorders per se, we will use the Centers for Medicare and Medicaid (CMS), ENT Model for the TMJ consultation. This is a comprehensive general physical exam of medical systems to include cardiac, pulmonary and a general head and neck evaluation, but in addition there is also the need for a very specific examination of the TMJ area for additional data. This information is then used and brought together for a review and discussion with the patient, parents, and others as needed.

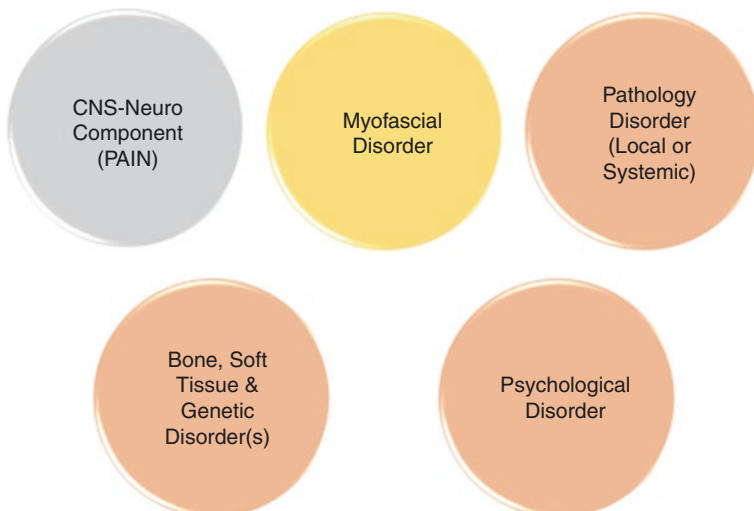
The chief complaint is the “primary problem” but may have secondary problems associated with this primary problem. Some of these secondary problems may actually be medical issues noted by the patient on the past medical history or in the review of systems. As the medical issues may overlap with the presenting problem, these medical issues may need to be resolved or corrected before any surgical intervention, such as psychological problems to include stress, migraine headaches (CNS pain), severe hypertension, uncontrolled diabetes, etc. This group of presenting problems will have a moderate to high severity level to ferret through and will take considerable time and effort in coming up with the “clinical diagnosis” and then the “treatment” for the malady. It is in this area of problems and complaints that we have to add “diagnostic information” called ICD (International Classification of Disease)-10 codes that describe the signs and symptoms of specific pathologies,

diseases, and illnesses. These ICD-10 codes are imperative to justify the need for surgical intervention. The “final diagnosis” will be saved for any biopsy of the soft tissues and bone of the offending joint and observed by a pathology service rendering a microscopic diagnosis. This diagnosis can perhaps be accomplished by arthroscopic intervention for diagnosis and biopsy prior to any additional surgery of the TMJ. Typically most patients are female (80%) and between the ages of 20 and 40 years old. However, these facts should not lead us away from the quest to gather all the information presented. In the circles of problems, diagnosis, and overlapping problems presented below, we see the potential complexity and the need to be stealth in our investigation as many false avenues can appear.

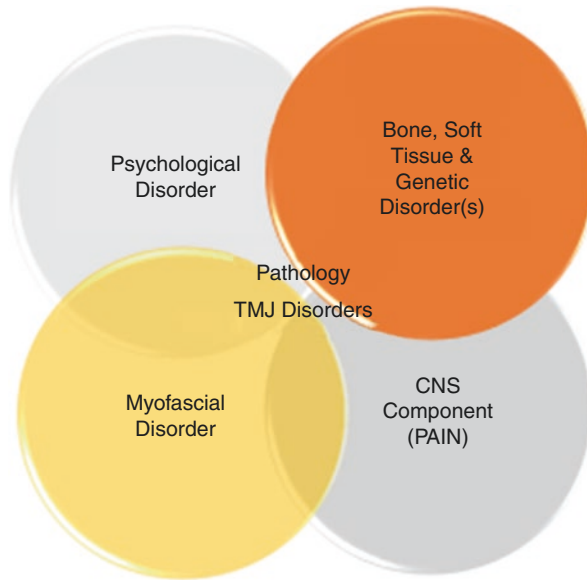
PROBLEM(S)



DIAGNOSIS (DIAGNOSES)



OVERLAPPING PROBLEMS MEAN
AN OVERLAP IN THE DIAGNOSIS



2.2.2 The Importance of the Medical and Dental History and Review of Systems

As part of the comprehensive consultation, the history and physical evaluation begins with the review of the **past medical history (PMH)** and **systems review (ROS)** as noted by the patient or parent filling out information that is usually pre-printed. In the PMH and ROS, we can include allergies to medications, medicines (routine and past), brain (neuro-trauma, stroke, epilepsy, early onset of dementia, etc.), pancreas (diabetes or diabetes in the family), head and neck (tumors, injury, etc.), other endocrine (thyroid, adrenals, etc.), cardiac (angina, coronary artery disease, hypertension, arrhythmias, etc.), pulmonary (asthma, COPD, emphysema, etc.), kidney, gastrointestinal, vascular (coronary or other arterial occlusions), bones and joints, surgery, sleep, cancer, family, and social history. Any positive answers by the patient or guardian must be investigated. Likewise the patient or guardian may miss one of the specific topics and so all of these items must be addressed by the examiner to verify the medical status of the patient.

After gathering the information on ROS and PMH, we then move to document the history of present illness as noted above. This is the start of our quest for determining the correct “clinical diagnosis.” The history of present illness (HPI) or the very reason the patient is coming to see you today will give us a checkoff list of the patient’s complaints and problems. What is the chief complaint (CC)? In this review we want to know the past history of any facial, neck, or head trauma and the cause, any past surgical history, when and why, where is the problem, etc. also when doing the HPI using the chart below which are helpful and have the patient

place a value number on certain problems. As will be noted later, there is a cross-over with the etiology of TMJ disorders which will be added to all the information gathered in the HPI.

2.2.3 The Chief Complaint or the History of Present Illness

The history of present illness (HPI) speaks to the very reason for the evaluation and gives some insight into the patient as well.

This can be described by the WHO—the patient is a ... *year old, male or female*, presenting with the symptom or chief complaint of:

<i>Location of the symptom:</i>	WHERE: facial, TMJ, right vs. left, others
<i>Intensity of the symptom:</i>	HOW GREAT: scale of 1–10
<i>Quality of the symptom:</i>	WHAT AND HOW MUCH: burning, pulsating, others scale 1–10
<i>Onset of the symptom:</i>	WHEN AND HOW MUCH: time line, precipitating factors, others
<i>Symptom radiates:</i>	WHERE: right temple area, left angle of the mandible, etc.
<i>Associated symptoms:</i>	WHAT AND WHERE: pain behind the eye, numbness, etc.
<i>Alleviating factors:</i>	WHAT AND HOW: not eating certain foods, ice, heat, etc.
<i>Aggravating factors:</i>	WHAT AND HOW: eating, chewing hard food, talking, etc.
<i>Evolution of symptoms:</i>	WHEN, HOW LONG: started 3 years ago, yesterday, unknown, etc.
<i>Treatment by others:</i>	WHAT, WHEN, & WHO: exam, surgery, dentists, PCP, PT, etc.

2.2.4 The Examination

As noted, the TMJ examination is based on using the CMS ENT model for the examination. This model can be found on the CMS Web site: [http://www.entnet.org/sites/default/files/1997-Documentation-Guidelines-for-Evaluation%20\(3\).pdf](http://www.entnet.org/sites/default/files/1997-Documentation-Guidelines-for-Evaluation%20(3).pdf).

The examination is complete for all systems to include a complete evaluation of the head and neck. But remember we seek to evaluate the TMJ and must do even more! The ENT model looks like other specialty models but is concentrating on the head and neck more than, say, a neurology or podiatric examination. TMJ examination will have some overlap with the ENT model and this should be noted.

Elements of the exam will start by measuring the seven vital signs, and CMS notes that any three of these elements need to be measured. These include sitting or standing blood pressure, supine blood pressure, pulse rate with regularity and with ECG, respiration rate, temperature, height, and finally weight + calculation of the BMI. In the ENT examination, note that the measurements of vital signs can be performed and recorded by ancillary staff members. Also note the general appearance of the patient (development, nutrition, body habitus, deformities, attention to grooming). Also assess the ability to communicate with the patient (use of sign language or other aids and quality of voice). Note the limited evaluation of the head and neck. This part includes inspection of the head and face (appearance, scars, lesions, and masses), palpation and/or percussion of the face with notation of the presence or absence of sinus tenderness, examination of salivary glands, and

assessment of facial strength. Examine the eyes and test for ocular motility including primary gaze alignment. In the ENT exam these are the most comprehensive parts: ears, nose, mouth, and throat. Otoscopic examination of external auditory canals and tympanic membranes (TM) includes:

- Pneumatic otoscopy with notation of mobility of the TMs
- Assessment of the nasal mucosa, septum, and turbinates hearing with tuning forks and clinical speech reception thresholds (e.g., whispered voice, finger rub)
- External inspection of the ears and nose (overall appearance, scars, lesions, and masses). Inspection of the nasal mucosa, septum and turbinates using a nasal speculum
- Inspection of the lips, teeth, and gums. Examination of the oropharynx: oral mucosa, hard and soft palates, tongue, tonsils, and posterior pharynx (asymmetry, lesions, hydration of mucosal surfaces)
- Inspection of pharyngeal walls and pyriform sinuses (pooling of saliva, asymmetry, lesions)
- Examination by mirror of the larynx including the epiglottis, false vocal cords, true vocal cords, and mobility of the larynx
- Examination by mirror of the nasopharynx including the appearance of the mucosa, adenoids, choanae, and eustachian tubes

In the ENT exam, more attention is paid to the ear, nose, and throat and not to the oral cavity and corresponding areas. In the neck, examination of the neck for masses and overall appearance are to be noted. Additionally, note the symmetry, tracheal position, and crepitus and examine the thyroid for any enlargement, tenderness, masses, nodules, deviation, etc.

1. **Respiratory examination** includes inspection of the chest including symmetry, expansion and/or assessment of respiratory effort (intercostal retractions, use of accessory muscles, diaphragmatic movement), and auscultation of the lungs (breath sounds, rubs, and adventitious sounds). In the ENT exam, we have duplication with our additional head and neck exam and these are ok. Note that the auscultation of the lungs should be in the front and back and in all areas of the lobes (three right and two left).
2. **The cardiovascular examination** begins with auscultation of the heart with notation of abnormal sounds and murmurs. Additional examinations of the peripheral vascular system are by observation (swelling and varicosities) and palpation (pulses, edema, pitting edema, tenderness, temperature, etc.). Note the auscultation of the heart and document.
3. **Lymphatic system** examination of the neck with notation of nodes and tenderness.
4. **Neurologic and psychological** evaluation and examination: Test all cranial nerves II–XII and note deficits. For the psychological evaluation, note orientation to person, place, and time. Also assess mood and affect, and note depression, anxiety, agitation, etc. Pain and is this real or imagined?

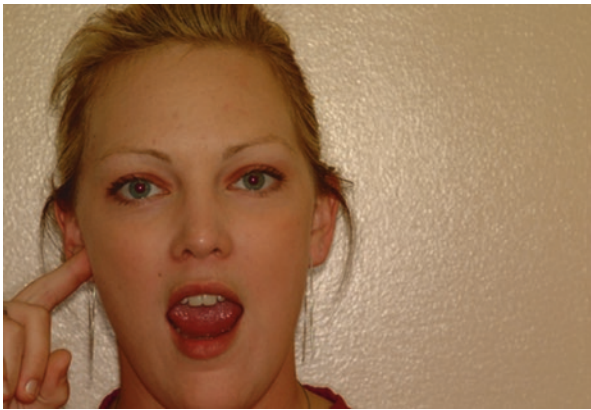
After following the CMS ENT model as a guide, we will need additional information which is very specific for the TMJ area. As noted before these consultations follow CPT guidelines, and thus we use **evaluation and management (E and M)** levels (1–5), and the criteria relates to **history** (one key), **examination** (one key), **medical decision making** (one key), and others that include counseling and coordination of care, nature of the problem, and time. Adding this together we still are missing the specifics of the TMJ per se exam. So now we have the past medical history, the review of systems, the history of present illness, and now the ENT model examination. We still need the additional information to assess the TMJ disorders, and thus we will move to the additional examination of the patient. Note that the essentials of a comprehensive consultation as above (by AMA CPT and CMS) are necessary to qualify for that level of E and M. Thus to complete this, we not only need the additional head and neck examination but also the element of medical decision as a key and additional information to be gained by (1) counseling and coordination of care and (2) nature of the problem (etiology) and time (how much time did you spend face to face with this patient for all of the above?). All of this information added together will advance us to the level of consultation in the office for a new or established patient: note in CPT CODE 99224 with attention paid to the fifth number “4.” But we still need additional information, which will now follow.

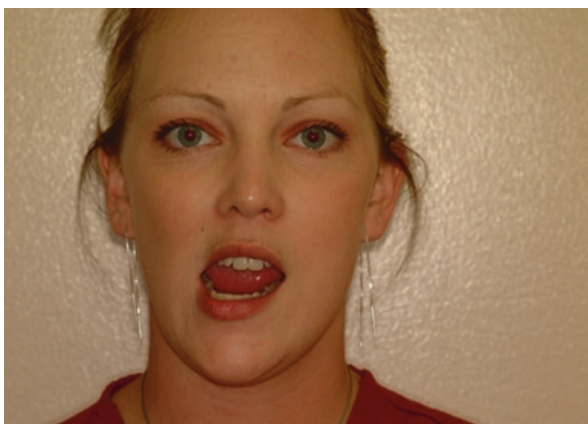
2.2.5 Additional Head and Neck Evaluation for the TMJ

As noted this is a very long and complicated exam and is based on the CMS ENT model, but in addition we will need very current vital signs to include blood pressure, pulse, SPO₂, ECG, temperature, weight, and BMI-specific information relating to the TMJ, if this was not performed in the ENT exam. Evaluation of the mental status is always a part of any consultation, and the TMJ is no exception, if this mental assessment has not been performed in the ENT exam. The initial psychological evaluation should involve mood, affect, and ability to identify time, person, and place. Since pain is usually the initiating symptom, the ability to know that the pain is a real symptom and not imagined can be a real extra problem. If the mental evaluation is uncertain, then referral to the primary care provider for a psychological evaluation would be the most appropriate especially if no real TMJ pathology can be determined.

Continuing to the additional head and neck evaluation would be to evaluate the cranial nerves II–XII, if not already performed in the ENT exam. Check the eyes, pupils, and eye movements and record any abnormalities. Next perform an evaluation of the entire range of mandibular motion to include measurements (using a millimeter ruler or gage) and notation of any deviation of the mandible to the right or left and also note any decreased opening in a vertical direction (normal vertical

opening is 40–50 mm, lateral and protrusive movements are 7–11 mm). Next will be an auscultation of the right and left TMJ on the vertical opening (note any noises on the opening and closing, the mm of the noise for both opening and closing, and also any noises on lateral excursions, loudness, and mm if possible. Noises come in different varieties: soft, loud, clicking, grating, and grinding. Note the intensity of the noise and the kind of noise. At this time in the exam, we can also use the stethoscope and listen to the right- and left-external carotid arteries and note any noises, bruits, or decreased sounds. Palpate all the head, neck, and shoulder muscles, and note any pain and where in these muscles and the degree of pain elicited by the patient. Check for hyperplasia of the masseter and temporalis muscles by having the patient bite their teeth together while palpating those muscles. If there is a dramatic size increase in the contracted muscle, then note the size increase. If pain or tenderness to muscular palpation is negative, then mark at zero, if mild then mark at 1/4, if moderate then mark at 2/4, if moderate to severe then mark at 3/4, and if barely touching the muscle producing severe pain, then mark at 4/4. Also note where on the muscle mass the pain occurs. Palpate the areas of the sinus, both the frontal and maxillary, and note any tenderness. Palpation and inspection of the ear, ear canal, and preauricular area should begin by inspecting the ear and the ear canal with an otoscope. Note any external ear wounds, scrapes, infections and condition of the tympanic membrane, ossicles and any inner ear infections, or other pathologies. At this point palpation of the preauricular area is begun, and note any pain or tenderness in the area. It is best to have the patient open as wide as possible and to place the index finger in the “preauricular depression” created, and note any pain produced. Negative response would be 0/4, mild pain would be 1/4, moderate pain would be 2/4, moderate to severe pain would be 3/4, and barely touching the area and eliciting severe pain would be 4/4. Using a nasal speculum, examine each nostril, note any inflammation of the nasal mucosa and size of the turbinates, and note the nasal septum and any deviation or other abnormalities, if not already performed in the ENT exam. In the neck examine the thyroid, and note any enlargement in the right and left side and any nodules present, if not already performed in the ENT exam. Also in the neck, examine the lymph nodes, and note any increase in size and tenderness, if not already performed in the ENT exam. An oral exam is performed next and last. This involves the soft and hard tissue examination and is also performed noting the mucosa status; gingival and periodontal status; missing teeth and general dental health status; dental abrasion and abnormal wear facets of incisal areas (bruxism and clenching); if third molars (maxillary and mandibular) are present, erupting, inflamed, or infected; the dental occlusion and classification; cranial bone classification; tongue size; tonsils if present and its status; parotid and submaxillary size and flow of saliva, if not performed in the ENT exam; and finally the Mallampati classification I–IV relating to oral volume, tongue size, and pharyngeal airway patency.





Photos 1, 2, and 3 are prompted by asking the question “where does it hurt?,” and this information will help determine to a great extent if the problem or problems are specific to the muscles or the TMJ proper or both. Follow-up evaluation and palpation by the surgeon are always necessary to elicit the symptoms of pain in muscles and/or the TMJ proper. Neuromuscular pain can overlap with the pain and dysfunction of the TMJ and disc pathology and needs to be separated out, if possible. Photo 4 includes a clinical evaluation of the preauricular area especially by palpation, and inspection is important, and of course auscultation of the joint for noises in the range of motion is also important. In Photo 5 we ask the patient to open as wide as possible, and note any deviation from the midline. Checking for any deviation and consistency in that deviation in the mandibular movement is critical and perhaps pathognomonic of an internal derangement of the TMJ meniscus. If this is encountered, then verification with a MRI of the TMJ soft tissues is necessary. Confirmation of an anterior, medial, or lateral displacement of the disc will be noted and verified by the MRI to help identify the disc position and importantly give justification to any surgical intervention. Integration of this clinical material with MRI material can then be compared to the Wilkes classification and present to the patient and other necessary entities for verification of disease and for the surgical intervention.



Clinical evaluation of the sub-anatomic area of the TMJ is critical to note the masseteric hypertrophy as well as any parotid pathologies. Palpation of this area and noting swelling not related to muscle activity are critical. Additional information is also gained by checking the parotid flow during the intraoral examination. Observation of the inner ear and canal is also a critical step to make sure there is no ear-related pathology mimicking as a TMJ problem or vice versa. Document the muscle and capsulitis levels (0–4) in the chart! Note the palpation of the temporalis muscle insertion on the coronoid process intraorally and note if tender.

After the examination, we will now have a very good idea of any abnormal variations noting the following: preauricular pain, mandibular range of motion and noise with mandibular movements, muscle pain, increased muscle mass, oral and pharyngeal problems, and many others. We should note these abnormalities in the chart as we move forward in the evaluation process and toward the correct “clinical diagnosis.”

2.3 Radiographic Evaluation

Initial panorex radiograph can serve as a guide to any bony pathology (third molars, tumors, cysts, infections, etc.), asymmetry, bony ankylosis, condylar shape, etc. This initial panorex radiograph will help determine in some cases if the TMJ is a real causal entity. This initial panorex radiograph should be a regular protocol at the visit for the consultation. The radiograph below shows a multilocular cyst involving the ascending right ramus and condyle and coronoid process of the mandible. Good views of the TM joints can show degenerative joint disease and asymmetry of mandible, cysts, and other odontogenic problems. If condylar hyper- or hypoplasia is present, one should consider a bone scan to rule out continued growth of the condyle. If there is fusion of the condyle to the temporal bone (bony ankylosis) and decreased range of motion (ROM), we can proceed to additional radiographs such as CAT scan and perhaps a surgical intervention without a need for conservative treatment.

Radiographic and imaging for evaluation of TMJ disorders include panorex and open and closed TMJ radiographs, open and closed MRIs with T1 and T2 of the sagittal views and T1 of the coronal views, edge to edge T1 sagittal views, CAT scans, cone beam CAT scans, and bone scans for active growth using T-99 and other modalities.



T1-weighted MRI with maximum vertical opening showing anterior dislocation without disc reduction, left TMJ

The need for additional radiographs, MRIs, CAT scans, and bone scans can also be determined at this time and ordered. Evaluate the condyle shape and form. Look for irregularities in the smooth rounded normal contour. When in doubt order a CAT scan or cone beam CT to evaluate the condyles.

2.4 The Etiology for TMJ Disorders

“Problems” can be described according to many authors as falling into groups or types (I–V) similar to our circles of problems, diagnosis, and treatment sequences. These will help us to discover additional information to the chief complaint and the history of present illness and are as follows:

- Type I: Myofascial pain and dysfunction (bruxism, clenching, other muscle disorders, etc.)
- Type II: Malocclusion, genetic, syndromes, orthognathic surgery, and concomitant TMJ disorders
- Type III: Hard tissue trauma, micro or macro, and direct or indirect
- Type IV: Soft tissue trauma, micro or macro, and direct or indirect
- Type V: Systemic diseases, infections, and others

The etiology or the cause that the patient presents with these signs and symptoms is an important aspect of finding the problem, the “clinical diagnosis,” and thus a correct course of treatment. Identifying the cause of the patient’s CC will hopefully prevent a reoccurrence in the future. As an example, the patient with severe bruxism (abnormal attrition of the dentition) and neuromuscular pain (type I) but no MRI evidence of internal derangements should be treated conservatively with night guards and medications (such as low-dose Elavil). Type II patients present with genetic, syndrome, or other malocclusion disorders and may have concomitant TMJ disorders (internal derangements, condylar resorption from juvenile arthritis, etc.) which can be treated as a separate entity or together with repair of the genetic disorders combining orthognathic surgery and TMJ surgery. Type III patients may have a history of direct or indirect hard tissue trauma, such as facial fractures, and type IV patients may have a history of indirect or direct soft tissue trauma, such as whip-lash injuries, MVA, accidental facial trauma, general anesthesia with intubation, etc. When these patients in type III and IV show additional positive findings with MRI effusion, pain, jaw deviation, decreased vertical opening in the TMJ, etc., they can then be placed into the proper Wilkes classification as we shall see. Other patients with systemic disorders, collagen vascular disorders, juvenile rheumatoid arthritis, etc. (type V) will need initial and future medical intervention to prevent resorption of condyles or antibiotic intervention for the infections. If these initial treatments are unsuccessful, then future interventions, such as arthroscopic lysis and lavage, debridement, potential orthognathic surgery in the future, and possible bone grafting or total TMJ reconstruction, will need to be considered and presented to the patient, parents, and guardians.

The first involves muscular and myofascial issues. These can be multiple as in bruxism, grinding, or clenching habits. However, other potential muscular diseases and pathologies exist and so are on the lookout for problems like myositis ossificans, multiple sclerosis, and others. These long-term habits in some presentations can cause hyperplasia of the muscles of mastication especially the masseter and temporalis and show clinically as a “bulge” or increased size of those muscles. Eliminating these habits can correct the pain and dysfunction as long as there is not an internal problem with the TMJ itself. So any pathology of the TMJ proper must be looked into as well. If correcting the muscular problems (Botox for hypertrophy, physical therapy, orthotic devices, etc.) eliminates the TMJ problems, then we are finished. If not then the search goes on for the internal pathology noted above. There can be tendonitis of the temporalis tendon as well as a presenting pain in the TMJ area, so palpation of that tendon in the coronoid area, intraoral, is a must. We must distinguish between muscular pain and joint pain. Some of the muscles may also exhibit painful areas in the muscle, called “trigger points.” Injecting these areas with local anesthesia or acupuncture needle can eliminate the pain in those muscles. This procedure is helpful in making the diagnosis by elimination.

The second area involves any malocclusion or genetic bony/soft tissue problems that need to also be ruled out as we advance in our process. Orthodontia with traction and other devices can produce pain in the TMJ area. Some of the severe cases of malocclusion and bony/soft tissue abnormalities can be corrected by orthognathic surgery. There may also be concomitant TMJ problems which will need to be addressed either separately or together, so evaluation of any internal pathology with these cases is imperative.

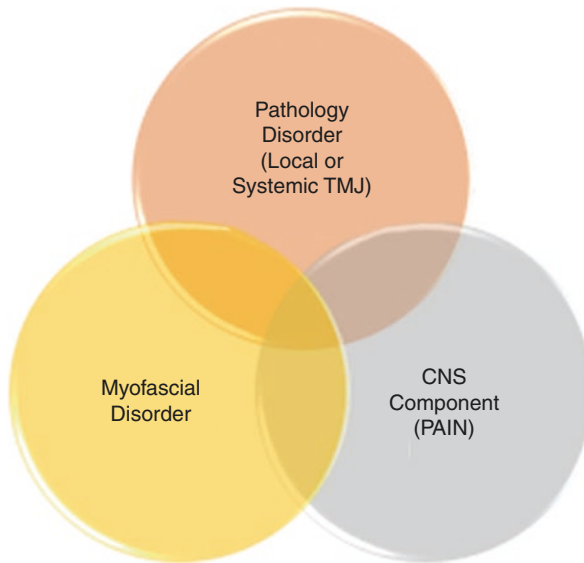
A third area is hard tissue injury via trauma to the head and neck which can produce a macro- and/or micro-injury to the internal TMJ with resultant pain and dysfunction. Some causes of this are motor vehicular accidents, whiplash injuries, sports-related injuries, direct altercations, difficult dental alveolar surgery including removal of difficult third molar teeth (wisdom teeth), general anesthesia with intubation, condylar fractures and the treatment of those fractures, and others.

A fourth area involves trauma to soft tissue and can occur in relation to all the reasons noted in number three above as well as direct laryngoscopy, esophagoscopy, intubation for anesthesia or other surgeries, and others.

A fifth area of concern involves some systemic diseases such as arthritis, rheumatoid arthritis, and collagen vascular diseases; infections in the TMJ area (acne), systemic or internal; and local dental or medical pathology which involves the TMJ by local invasion such as parotid tumors, mandibular cysts, etc.

Thus the history of the etiology gives us additional information and yet another method for determining (and perhaps in the future preventing) the “problem.” The specific and correct “clinical diagnosis” can then be addressed by using one or several parameters in combination such as the etiology, the Wilkes Classification, the Quinn’s classification, the synovial disorder list, or other specific straightforward problems like hypermobility or bony ankylosis. These will give us a good start to finding the appropriate treatment modality, nonsurgical or surgical. Remember that most TMJ disorders involve the triad of pain, myofascial disorders, and local TMJ pathology.

TYPICAL TMJ DISORDER PROBLEM(S)



The overlapping circles above represent the typical problems and hence diagnosis issues that are presented in most cases of TMJ disorders. This primarily involves pain in or around the TMJ area as the initial presenting problem. This also usually involves some element of dysfunction of mandibular motion (difficulty chewing, limited opening, jaw deviation, etc.). This also usually involves the muscles of mastication, and pain can be associated with these muscles per se and not involve any TMJ issues at all. Thus the overlap and need to address each of these problems. Do we do so together or separately? Well it depends.

Remember that the correct “clinical diagnosis” can involve many overlapping facets including:

1. Neurological (CNS) and muscular disorders of pain (headaches or TMJ specific) and myofascial disorders
2. Internal disorders of the TMJ proper with local or systemic pathology to include hard (arthritis) and soft tissue (disc and synovial pathology) pathology
3. Genetic and syndromes of the head and neck involving hard and soft tissue disorders
4. Psychological disorders
5. Combinations of the above

2.5 “Clinical Diagnosis” or Bust?

So now what do we do with all this information? We have a review of systems, a past medical history, the chief complaint, a history of present illness, overlapping areas that are “problems,” radiographs and MRI images, and now an etiology of how things

happened. So to putting altogether, we will proceed to the “clinical diagnosis” in several ways by using PCP, PT, DDS, etc. to eliminate these overlaps. If the overlapping areas were the real “problem,” then dealing with any local or systemic pathology of the TMJ may not be needed. Some overlapping areas are the following:

- If psychogenic then referral to the PCP, psychologist, or psychologist for treatment would be appropriate.
- If CNS pain, headache or migraines, then referral to the PCP or neurologist for treatment would be appropriate.
- If bony fractures then immediate treatment by OMS or other source would be appropriate.
- If there are craniofacial disorders, genetic bone/soft tissue disorders, and/or malocclusions (especially class II cases), then referral to an orthodontics and/or OMS would be appropriate.
- If primary arthritis of synovial nature, referral to a PCP and rheumatologist would be appropriate.

Eliminating the overlapping “problems,” we then arrive at a smaller subset of “problems” that we can now address as the “clinical diagnosis of TMJ disorders leading to a surgical correction” and that we initially set out to find. So to find this very specific and correct “clinical diagnosis,” we will take a look at synovial joint disorders, the Wilkes classification of internal derangements, chondromalacia, fibrous ankylosis, and bony ankylosis.

2.6 The Synovial Joint Disorders

Next, we will look at other causes of joint disorders, and these can involve the synovium of the TMJ in some very different ways. The synovium is the source of nutrients to the disc (meniscus) and lubrication of the internal normal function of the TMJ complex. It is also a potential source of pathology in any joint and specifically the TMJ and can be affected by many of the etiologies noted above. Synovial TMJ disorders can be classified as inflammatory or noninflammatory. Examples of inflammatory synovial disorders include pathologies of primary arthritis, secondary arthritis, and non-arthritis diseases. Primary arthritis is composed of several entities that include rheumatoid arthritis, juvenile arthritis, and HLA-B27-associated arthritis (including Reiter’s syndrome, psoriatic arthritis, others) and Behcet’s syndrome. Secondary arthritis is composed of traumatic arthritis, infective arthritis (many offending agents are possible and culture of the TMJ is necessary), crystal-induced arthritis (gout, uric acid crystals, others), and degenerative arthritis (degenerative joint disease or osteoarthritis as seen in Wilkes IV and V cases). The non-arthritis group is composed of internal derangements as seen in Wilkes I, II, and III cases and in synovial chondromatosis (calcified, loose bodies from inflamed synovium). Examples of noninflammatory synovial TMJ disorders are composed of aseptic necrosis, primary and secondary osteoarthrosis (normal wear of the joint bones with age), and hypermobility of the mandible cases.

The diagnosis of these synovial diseases may be evident from the age of the patient, MRI findings, clinical findings, lab data, etc. A generalized synovitis and pain in the preauricular area with a noted effusion (fluid) on MRI evaluation, and without apparent cause, can later be confirmed to a specific pathology only with a biopsy via arthroscopic intervention. Synovitis of the TMJ comes in many forms and levels of severity. Hence, the presenting “clinical diagnosis” can only take us so far.

2.7 The Wilkes Classification of Internal Derangements of the TMJ

In 1989, Dr. Clyde Wilkes of Minneapolis published his seminal work on classifying internal TMJ disorders involving the inside structures of the TMJ proper which included clinical, radiographic, and surgical descriptions of his findings. His classification of internal derangements of the TMJ is the gold standard. These findings included disc position and appearance, pain and noises, synovitis and adhesion, and degenerative joint bone changes and disease. We now use this classification for stratification and consistency in the grading of these diseases. In his studies he related the clinical findings, the radiographic findings, and the surgical findings to complete his five stages of the classification.

2.7.1 The Wilkes Classification of TMJ Internal Derangements

2.7.1.1 Stage I (Early)

- Clinical: No pain, reciprocal clicking early and late on opening with soft intensity, no restriction of motion or vertical opening, and no mechanical symptoms
- Radiographic/MRI: \pm effusions, no degenerative joint disease (DJD), slight anterior displacement of the disc
- Surgical: Normal anatomy with slight anterior displacement of the disc, \pm synovitis

2.7.1.2 Stage II (Early-Intermediate)

- Clinical: First few episodes of pain, occasional joint tenderness, and related temporal headaches. Beginning of mechanical problems with increasing joint sounds and late in opening and the beginning of transient joint subluxations with occasional catching or locking
- Radiographic/MRI: Slight forward displacement of the disc, slight thickening of the posterior edge, and the beginning of anatomical deformities via MRI, no degenerative joint disease noted. \pm Effusions
- Surgical: Anterior disc displacement and mild deformity, \pm synovitis

2.7.1.3 Stage III (Intermediate)

- Clinical: Multiple episodes of pain, joint tenderness, temporal headaches, major mechanical symptoms to include transient catching, locking (closed locks), restriction of motion, and difficulty with function. Noises \pm
- Radiographic/MRI: Anterior displacement with or without reduction and with significant anatomical deformity or prolapse of the disc. \pm Effusions. Normal tomograms and CAT scans and no degenerative joint disease
- Surgical: Anterior displacement of the disc with or without reduction, variable adhesions (lateral anterior and posterior), \pm synovitis, and no hard tissue changes

2.7.1.4 Stage IV (Intermediate/Late)

- Clinical: Characterized by chronicity with variable and episodic pain, headaches, variable restriction of motion and undulating course, noises \pm
- Radiographic: Increase in severity over stage III, abnormal tomogram, and CAT scan with early to moderate degenerative remodeling of hard tissues: + DJD
- Surgical: Increase in severity over stage III, hard tissue degenerative remodeling changes on both bearing surfaces, osteophyte projections, \pm synovitis, multiple adhesions (lateral, anterior, and posterior recess), and *no* perforation of the disc or attachment

2.7.1.5 Stage V (Late)

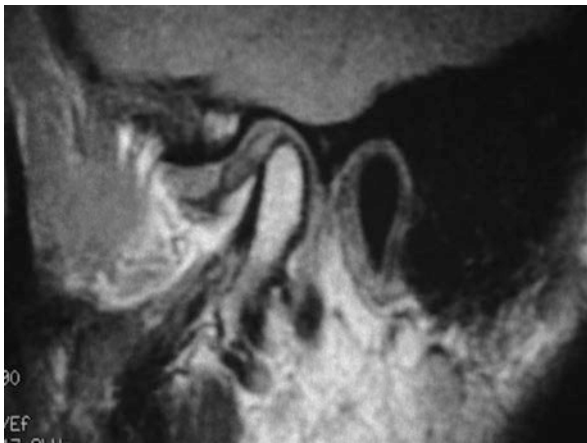
- Clinical: Characterized by noises of crepitus, scraping, grating, and grinding. Variable and episodic pain and chronic restriction of motion and difficulty with function
- Radiographic: Anterior disc displacement, perforation, gross anatomical deformity of the disc and hard tissue, abnormal tomograms and CAT scans
- Surgical: Gross degenerative changes of the disc and hard tissues. Perforation of the posterior attachments, erosions of the bearing surfaces and multiple adhesions equivalent to degenerative arthritis (sclerosis, flattening, anvil-shaped condyle, osteophyte projections), and subcortical cystic formation

With the progression of this disease, the articular disc becomes more and more displaced anteromedially, and finally the disc can become perforated, revealing the underlying bone of the condyle. Also with progression of this disease, the articular surfaces of the temporal bone undergo changes as well as the condylar bone which becomes degenerated with loss of normal rounded, healthy architecture and forms an anvil-like shape with spurs and bony spikes. This condition can on bone-on-bone contact produce the grinding and grating sounds noted clinically and on auscultation.

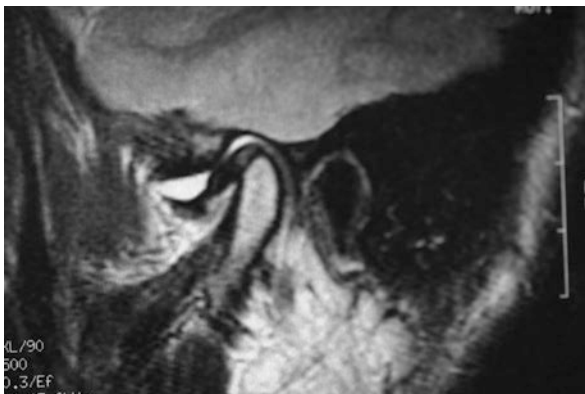
The Wilkes classification according to Dr. Kurt Schellhas (1989) showed consistent material for each stage and has helped define the MRI presentation within the Wilkes classification:

- Stage I: Disc displacement (minimal), normal disc, – degenerative joint disease (DJD) morphology, normal MRI signal, \pm effusion
- Stage II: Disc displacement and deformity (increased over stage I) \pm effusion, – DJD morphology
- Stage III: Same as II + ROM \pm reduction of disc on opening, \pm adhesions, \pm effusion, – DJD morphology
- Stage IV: Severe changes from stage III + osseous changes and + DJD morphology, \pm effusion
- Stage V: Perforation + osseous changes and + DJD morphology and increased over stage IV

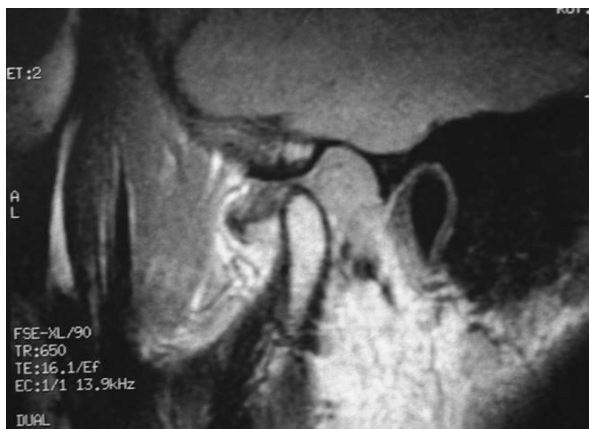
Kurt Schellhas: Internal derangements of the Temporomandibular Joint: Radiologic Stages with Clinical, surgical and pathological correlation. Magnetic Resonance Imaging. 7: 495–515, 1989.



T1-weighted MRI, closed mouth position: anterior disc displacement, mucoid degeneration, left TMJ



T2-weighted MRI with effusions (fluid), closed mouth position, left TMJ



T1-weighted MRI with maximum vertical opening showing anterior dislocation without disc reduction, left TMJ

Disc dislocation can also occur medially or laterally, and we will need coronal views of MRIs to see this malposition of the TMJ meniscus (picture). As noted the Wilkes classification of internal derangements is the gold standard for internal pathologies of the TMJ. There are other pathologies that this classification does not consider and those include chondromalacia, lateral impingement syndrome, primary and secondary osteoarthritis, hypermobility and multiple mandibular dislocations, fibrous ankylosis, and bony ankylosis. These conditions will be considered next.

2.8 Chondromalacia and the Lateral Impingement Phenomena

In addition to the synovial disorders, in the progression of the pathology noted in the TMJ, there are varying degrees of cartilage damage to the articular surfaces in the TM joint. The pathology or damage to these surfaces is described as chondromalacia. Dr. James H. Quinn defined these stages or grades in 1989. He noted that the mechanism of cartilage degeneration followed from stress/bruxism to chronic micro-trauma to compression and sheering to chondrocyte damage with release of collagenases to splitting of proteoglycans chains and water loss to loss of cartilage resilience and water reabsorption to frank chondromalacia. His stages or grades are as follows (note these stages of chondromalacia can only be confirmed via arthroscopic evaluation): grade I, on probing there is a softening of the otherwise firm cartilage; grade II, rupture of underlying fibrils producing an undulating surface with furrows; grade III, loss of base of the cartilage and production of fingerlike projections or fibrils; and grade IV, advanced stage of cartilage fibrillar degeneration with full thickness of cartilage and bone exposure.

Chondromalacia relates to the internal cartilage on the bony surface and the reaction to stress and inflammation as a resultant pathology and the progression of disease. These next several slides (if not shown in another area) show an arthroscopic view of the pathology of chondromalacia and how to determine the degree of

pathology and disease. It is necessary to have looked at these joints via an arthroscope or with an OnPoint (small diameter arthroscope) to make this diagnosis. Grades II and III show an increased in cartilage breakdown and progression of the pathology. Grade IV is the highest form and usually shows fibrous adhesions to the articular disc as noted on the right.

The lateral impingement phenomenon from Dr. Jeff Moses relates to fibrous or scar tissue developing between the lateral ligament and the temporal bone in the anterior lateral synovial pouch. This problem will decrease the ability to enter into the anterior synovial space via arthroscopy. By releasing these adhesions, this will allow for increased volume in the anterior synovial space and will allow for easier arthroscopic access to this space and for visualization of this space. Clinically, this will also allow for increased vertical opening.

2.9 Primary and Secondary Osteoarthritis, Condylar Hypoplasia, and Condylar Hyperplasia

Some patients present with no clinical symptoms but have degeneration of the condyles from age and normal wear. If symptoms of pain and dysfunction are not present and normal function is uninterrupted, then no treatment is recommended. As noted with time and wear, the condyles can show radiographic resorption. When this resorption occurs at a young age, then this is termed idiopathic condylar resorption and shows loss of condyle or condyles. This typically occurs in young women, and hence the term “cheerleader condition” describes those cases. The opposite occurs when condylar growth occurs either unilateral or bilateral (as in growth producing a class III genetic bony protrusion or prognathism). In unilateral condylar hyperplasia, this can result from an osteochondroma (rare in the TMJ) or unabated growth with normal bone formation. A biopsy would need to identify the difference.

2.10 Hypermobility and Mandibular Dislocation and Hypomobility: Coronoid Elongation, Ankylosis of the TMJ—Fibrotic and Bony

Patients with hypermobility of the mandible and with multiple dislocations of the condyle out of the fossa can have a central nervous system causality. These problems include epilepsy, Parkinson’s disease, and other neural activity. If medications cannot prevent the hypermobility and dislocations, then a surgical treatment of the hypermobility and multiple dislocations can be an option and will be covered in the surgical chapter on correction of persistent dislocation and hypermobility.

However, patients with the inability to open because of an increased restriction of motion and pain can be due to several etiologies: to coronoid hyperplasia, to a

2.11 Conclusion

The correct “clinical diagnosis” of any disease shows us the pathway to treatment whether medical, dental, or surgical. Making the “correct clinical diagnosis” can be a real challenge no matter what the malady, but this is especially complicated in assessing disorders of the TMJ (the most complicated joint in the body). Thus, the above gathering of information for diagnosis is imperative for any future treatment and any hope of improving the patient’s quality of life. From the comprehensive consultation, we should then be able to make a medical decision on what to do next, but as noted this is very complicated. We need to identify the overlapping problems, to recognize medical problems and refer to medical colleagues for appropriate treatment, to recognize dental problems and refer to other practitioners for potential treatments, to decide whether we should take on the problems and diagnoses together or separately, to decide where to start (pain and function should come first), to eliminate the peripheral problems, and to end up with a “correct clinical diagnosis.”

There can be stages of nonsurgical intervention or specific surgical treatments to be performed, and that is for another chapter. Incorporating all the above information will help on the way to identify the “problem or problems” and make the “correct clinical diagnosis” to present to your patient as the correct path to surgery and surgical correction. Remember that there is a great potential for overlap in the problems presented and in the diagnosis that follows. For the specific treatment, we must concentrate on the problems presented, eliminate the non-problems, and follow the real problems. This will lead to the correct “clinical diagnosis” and then to an appropriate surgical algorithm and a surgical treatment proposal.

Bibliography

1. Solberg WK, et al. Prevalence of mandibular dysfunction in young adults. *JADA*. 1979;98:25–34.
2. Widmark G. On Surgical intervention in the temporomandibular joint. *Swed Dent J*. 1997;123:1–87.
3. Kuttilla M, et al. TMJ treatment in relation to age, gender, stress and diagnosis subgroup. *J Orafac Pain*. 1997;12:67–74.
4. Rugh JD, Solberg WK. Psychological implications in TMJ dysfunction. *Oral Sci Rev*. 1976;7:3–30.
5. Mohl ND, Ohrbach R. The dilemma of scientific knowledge versus clinical management of TMD. *J Prosthet Dent*. 1992;67:113–20.
6. Rasmussen OC. Description of population and progress of symptoms in a longitudinal study of TMJ arthroplasty. *Scand J Dent Res*. 1981;889:196–302.
7. Milam SB. Pathogenesis of degenerative TMJ arthritis. *Odontology*. 2005;93:7–15.
8. Harris JG, et al. Update on the treatment of juvenile idiopathic arthritis. *Curr Allergy Asthma Rep*. 2013;13:337–46.
9. Henry CH, et al. Reactive arthritis: preliminary microbiological analysis of the human temporomandibular joint. *J Oral Maxillofac Surg*. 2000;58:1137–42.
10. Cai RJ, et al. Osteochondroma. *Oral Surg Oral Med Oral Pathol*. 2012;114:66–74.

11. Khuarna J, et al. Bone tumors: clinical, radiological and pathologic correlation. Philadelphia: Lea and Febiger; 1989. p. 234–7.
12. Wolford L, et al. Low condylectomy and orthognathic surgery to treat mandibular condyle osteochondroma: a retrospective review of 37 cases. *J Oral Maxillofac Surg.* 2014;72:1704–28.
13. McCain JP, et al. Temporomandibular arthroscopy: a 6-year multicenter retrospective study of 4831 cases. *J Oral Maxillofac Surg.* 1992;50:926–30.
14. Israel H, et al. The relationship between TMJ synovitis and adhesions: pathogenic mechanism and clinical implications for surgical management. *J Oral Maxillofac Surg.* 2006;64:1066–74.
15. McCain JP, Hosameldin RH. Advanced arthroscopy of the TMJ. *Atlas Oral Maxillofac Surg.* 2011;19:145–67.
16. Wilkes CH. Internal derangements of the temporomandibular joint, pathologic variations. *Arch Otolaryngol Head Neck Surg.* 1989;115:469–77.
17. Schellhas KP, Wilkes CH. TMJ inflammation: comparison of MR fast scanning with T1- and T2-weighted imaging techniques. *Am J Roentology.* 1989;10:589–94.
18. Schellhas KP. Internal derangements of the TMJ-radiologic staging with clinical, surgical and pathological correlation. *Magn Reson Imaging.* 1989;7:495–515.
19. Ikeda K, Kawamura A. Disc displacement and changes in condyle position. *Dentomaxillofac Radiol.* 2013;42:84227642.
20. Bronstein SL, Merrill RG. Clinical staging for TMJ internal derangements: application to arthroscopy. *J Craniomandib Disord.* 1992;6:7–16.
21. Mercuri LG. A practical approach to management of TMJ disorders. Lectures to TMJ surgery mini residency course, August 2016, Baltimore.
22. [http://www.entnet.org/sites/default/files/1997-Documentation-Guidelines-for-Evaluation%20\(3\).pdf](http://www.entnet.org/sites/default/files/1997-Documentation-Guidelines-for-Evaluation%20(3).pdf).
23. Laskin DM, Greene CS, et al. TMJ disorders: an evidence based approach to diagnosis and treatment. Chicago: Quintessence; 2006.
24. Moses JJ, et al. The effects of arthroscopic lysis and lavage of the superior joint space on TMJ disc position and mobility. *J Oral Maxillofac Surg.* 1989;47:647–8.
25. Moses JJ. A functional approach to the treatment of TMJ internal derangements. *J Craniomandib Disord.* 1991;5(1):19–27.
26. Dolwick MF, et al. Internal derangements of the TMJ: fact or fiction? *J Prosthet Dent.* 1983;49:415–8.
27. Moses JJ. Lateral impingement syndrome and endaural surgical technique. *Oral Maxillofac Surg Clin North Am.* 1989;1:175–83.
28. Moses JJ, Poker ID. TMJ arthroscopy- the endaural approach. *Int J Oral Maxillofac Surg.* 1989;18:347–51.
29. Politi M, Sembronio S, et al. High condylectomy and disc repositioning compared to arthroscopic lysis, lavage and capsular stretch for the treatment of chronic closed lock of the TMJ. *Oral Surg Oral Med Oral Pathol.* 2007;103:27–33.
30. Quinn JH. Arthroscopic and histologic evidence of chondromalacia in the TMJ. *Oral Surg Oral Med Oral Pathol.* 1990;70:387–92.
31. Quinn JH. Arthroscopic management of TMJ disc perforation and associated advanced chondromalacia by discoplasty and abrasion. *J Oral Maxillofac Surg.* 1994;52:800–6.
32. Murakami K. Reliability of a negative clinical TMJ examination: a prevalence of disk displacement in asymptomatic temporomandibular joints. *Oral Surg Oral Med Oral Pathol.* 1989;68:551–4.