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Fundamental Principles of the Comprehensive Approach

The foundation of a comprehensive practice is a four-part comprehensive evaluation. Dentists often say that they will do a comprehensive evaluation, diagnosis, and treatment plan if the patient is "having a problem" or if it appears to be "a big case." First, how do you know whether there is a problem unless the complete exam is done? You can base it on the patient report of symptoms, or lack of symptoms, but there can be significant changes or issues with components of the masticatory system without manifestation of symptoms. These symptom-free issues, also known as *signs*, can have a significant impact on a treatment plan and the stability of the results. Second, how do you know whether it will be a "big case" unless a complete exam is done? Without the exam, the evaluation is usually based just on an obvious deterioration of teeth or missing teeth and the presence of crowns, bridges, or implants—and if these obvious issues are not present, it is deemed not to be a "big case."

Part of the problem is with the term *big case*. It is usually synonymous with needing many units of crowns or bridges. An even bigger problem is falsely assuming that a *comprehensive* case implies a *big* case. Even a simple restorative case—that is, some simple restorations on just a few teeth, with concurrent occlusal management for predictability of the restorative result and for long-term health of the patient's temporomandibular joints and neuromuscular system—should be a comprehensive case.

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The Case for the Four-Part Comprehensive Evaluation

What is the rationale of a four-part comprehensive evaluation for patients who have healthy teeth and periodontium, are not complaining of pain or dysfunction, and are not in need of any significant restorative dentistry? Simply put, it serves as a baseline for future comparison. We may not see issues that are immediately in need of treatment, but there are often issues that are not ideal but still do not warrant treatment. These are described as *observations* and not *problems*. Examples include slight wear, gingival recession, erosion, and abrasion, etc. If we do a complete baseline examination, at some future point we can repeat this examination and compare it to the baseline. If nothing has changed, we can assure the patient. If any of these issues has gotten worse, we now have the baseline to compare to and have a more valid rationale for suggesting treatment. It is easy for the patient to see the progression especially when comparing photographs and diagnostic casts. Our role as dentists is not just to repair what is broken but to prevent future breakdown and maintain optimal health.

The Details of the Four-Part Comprehensive Evaluation

Figure 1.1 illustrates all the components of the four-part comprehensive evaluation. With the initial interview, clinical examination, necessary imaging, and articulated diagnostic casts completed, we have all the information needed to make a diagnosis and formulate an appropriate treatment plan and treatment sequence. With this complete information about our patients and their masticatory systems, they can "be in our office" even after they have left. Now we can invest some thinking time to sort through all the information. What

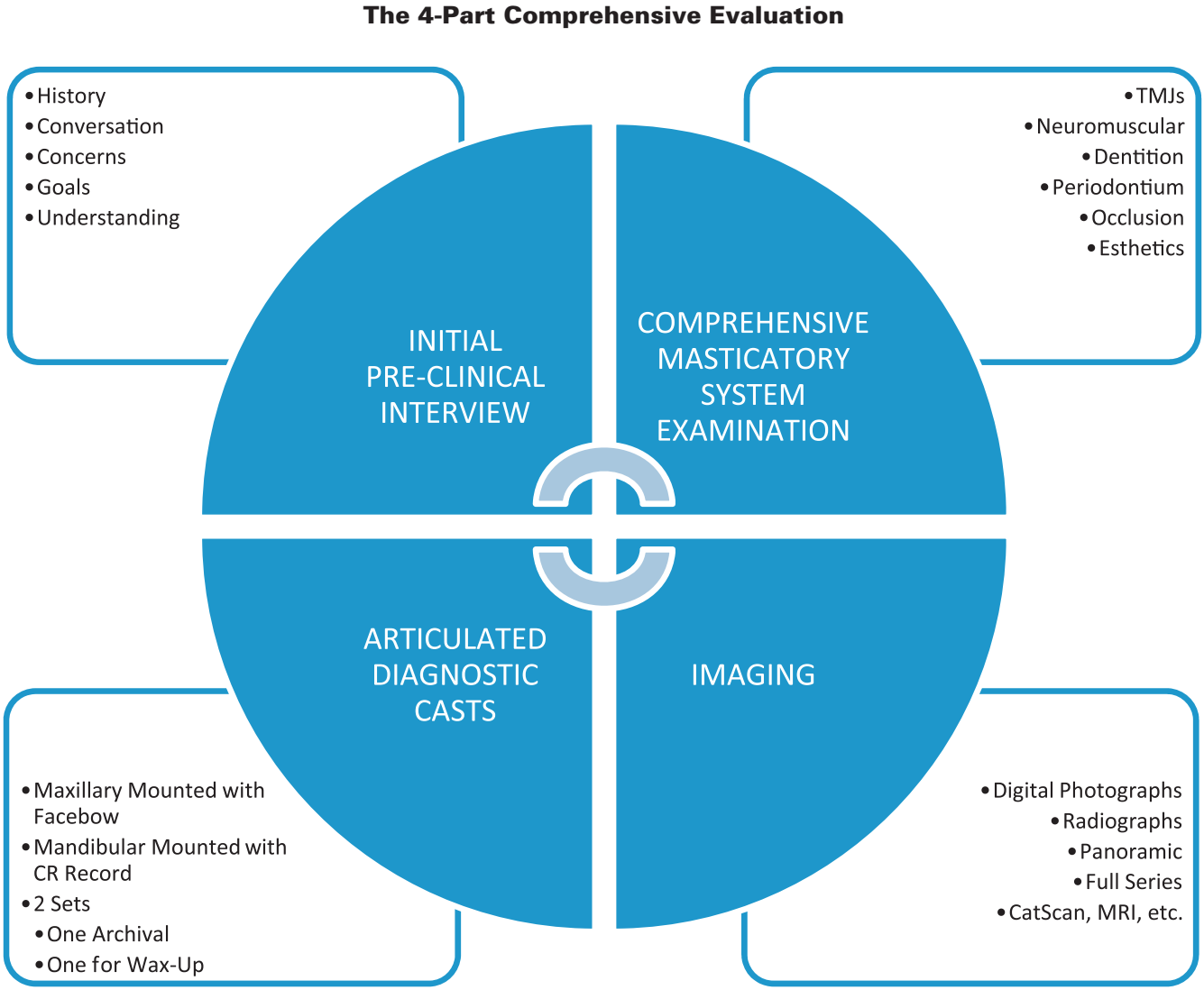


Figure 1.1. The four-part comprehensive evaluation gives us a complete picture of the patient's masticatory system—the starting point for diagnosis and treatment planning.

a valuable service for our patients! This is behind-the-scenes work that we are investing on behalf of our patients. Be sure that you and your team communicate to your patients that you are investing this time on their behalf. If they do not know that you are investing the time, they cannot value and appreciate that effort. Their perception is reality, so be sure that their perception is correct.

The Initial Conversation

Figure 1.2 illustrates all components of the complete clinical masticatory system examination. After the patient calls the practice, has an initial conversation with the administrative assistant, and is appointed, the process should continue with a one-on-one conversation with the dentist. The purpose of this conversation is for the dentist to get to know the patient, and vice versa, and basically to get the process started on a personal level. The medical and dental history is reviewed and an attempt is made by the dentist to understand the patient's concerns, desires, and expectations. It is a time for the patient to do most of the talking and for the dentist to do most of the listening. Talking on the part of the dentist should be mainly in the form of questions to help better understand what the patient is trying to convey. Many times, dentists do too much talking during this initial conversation—telling the patient about ourselves, our practices, and the services that we provide for our patients. There certainly is a need to talk about these things, but this initial conversation is not the proper time. As we listen to the patient's conversation we

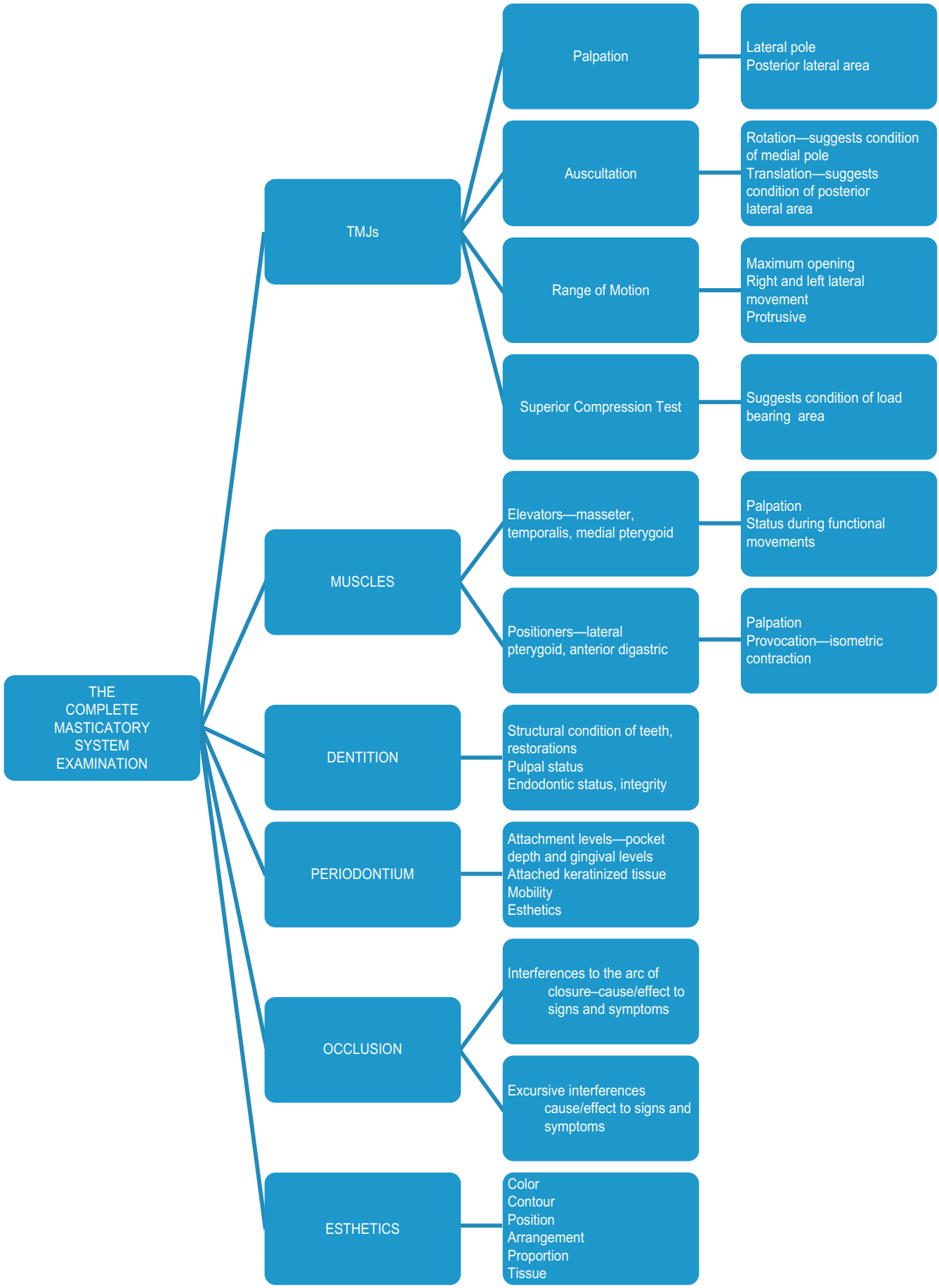


Figure 1.2. The clinical examination of the masticatory system follows this protocol so that nothing is overlooked. It is a pragmatic, step-by-step, systemwide approach rather than just a symptom-based approach.

need to control the urge to offer an answer or a solution; rather we should think of the right question to ask to help us better understand what the patient is trying to tell us. This initial conversation can set the tone for the entire relationship that follows. We want patients to leave this conversation feeling that it is about them and that their best interests are at the top of the list. Once we have listened and truly understand the concerns of the patient, it is a very natural transition to the complete masticatory system examination.

The Clinical System–Based Masticatory System Examination

The second step is a clinical examination of all components of the masticatory system (refer to Figure 1.1). It is important to say that this is a system-based examination and not just a symptom-based examination. It needs to be a systematic, step-by-step evaluation. A lack of symptoms is not a reason to not complete a certain aspect of the clinical evaluation. For example, just because the patient may not complain of temporomandibular joint symptoms does not mean that we should not do a thorough temporomandibular joint examination. There can be significant intracapsular changes with no report of symptoms, and these changes can have significant implications on the long-term stability of our restorative and occlusal results. Knowing and understanding this at the beginning of the case is much better than being unprepared if it becomes an issue after we begin the case. If we know about it ahead of time it's called a *diagnosis*. If we find out about it after we began the case because of some issue or problem that arises, we find ourselves making excuses and explanations. An after-the-fact excuse is never going to satisfy the patient. It will always seem to be an oversight on the part of the dentist.

Figure 1.3 illustrates all the parts of a comprehensive clinical masticatory system evaluation. Each part

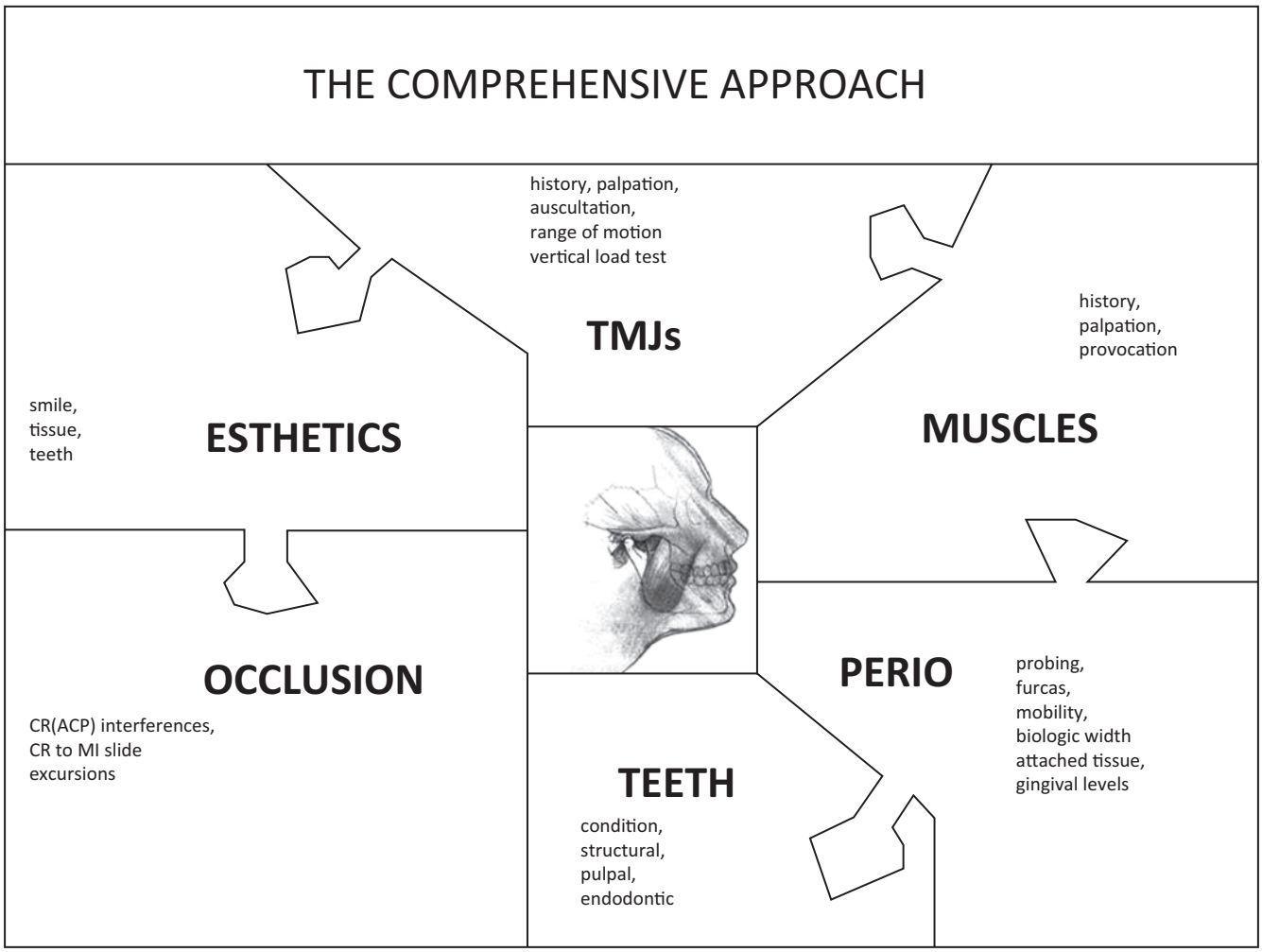


Figure 1.3. The complete masticatory system examination supplies all the pieces of the puzzle to get a complete picture.

of the examination is like a piece of the puzzle. As we complete all parts of the examination we then have all the pieces of the puzzle to accurately visualize the current status of the patient's masticatory system. Being thorough and complete with the examination goes a long way to ward eliminating oversights and mistakes in the future.

We need to have a systematic, step-by-step pragmatic approach to the evaluation of all the components of the masticatory system, but we need to be flexible in how we begin and go through the various parts, primarily with the behavioral aspects of a comprehensive evaluation, which are covered in more depth and detail in Chapter 2. Basically we want to use the information that we gather during the initial conversation with the patient to guide us through the various parts of the clinical evaluation. For example, if the patient reports a temporomandibular joint problem, the logical place to start is the temporomandibular joint examination. If the patient reports headaches and muscle tension, we consider beginning with the muscle palpation part of the examination. Doing the examination in this way illustrates to patients that we have not forgotten about their chief concerns. You will find patients are more interested and receptive during the examination when it is about them. We don't want the examination to be something that we do "to" patients but rather something that is done with the active participation of patients.

The Four-Part TMJ Examination

The temporomandibular joint examination consists of four parts: palpation; auscultation; range of motion tests; and superior compression test, also known as a *vertical load test*. This four-part test, along with any necessary imaging, will suggest to us the condition of the components of the temporomandibular joint.

Figure 1.4 illustrates palpation of the temporomandibular joints. With the mandible closed we can palpate the lateral pole and associated structures. With the mandible opened widely and the condyles translated down and forward along the articular eminence, we can palpate the posterior aspects of the temporomandibular joints. Healthy structures should not be uncomfortable or painful to palpation. Gently touch the patient's shoulder and explain that this represents simply the pressure of the touch. On a scale of 1 to 5, the pressure of the touch is zero. If patient feels more than just a pressure of the touch, ask them to rate the discomfort on a scale of 1 to 5. Tenderness or discomfort to palpation suggests edema or inflammation in those structures. Discomfort to palpation on the lateral pole suggests issues with the lateral aspect of the disc or capsule. Discomfort to palpation of the posterior aspect of the condyles suggests edema or inflammation in the retrodiscal tissues.

Figure 1.4. Palpation of the lateral pole with mandible closed and posterior-lateral area with the mandible open.

Temporomandibular joint issues often have trauma as a contributing factor. It may be microtrauma such as bruxism or macrotrauma such as an accident. Talk to the patient about any past history of trauma, as insignificant as it may seem. A bump to the chin or a sporting accident as a teenager may have been a significant event in the adult patient's current temporomandibular joint condition.

Figure 1.5 illustrates one aspect of the range of motion tests. Maximum opening and full movement to the left, right, and protrusive are measured. These should be pain-free movements. Ask the patient whether any discomfort is felt during these range-of-motion tests and, if so, to specifically point to the area

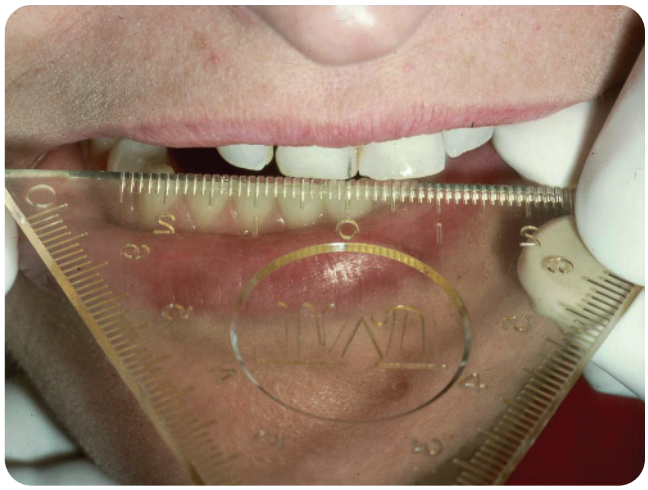


Figure 1.5. Measuring right lateral excursive movements with a millimeter ruler. Maximum opening, left lateral excursions, and protrusive are also measured.

Figure 1.6. Use of Doppler ultrasonography is an effective way to auscultate the temporomandibular joints. Auscultation in hinge rotation gives information regarding the medial pole. Auscultation in translation gives information regarding the superior-lateral aspect of the temporomandibular joints.

of discomfort. It may be muscles, joints, or both. This not only gets the patient involved but it also helps you get a sense of condylar movements and muscular coordination. Maximum opening averages 45–55 mm, excursive movements average 9–12 mm. These averages represent approximately a 4:1 ratio between maximum opening and excursions. Deviations from these averages or this ratio might suggest problems with intracapsular structures or muscle coordination. Smaller ranges may not necessarily be a problem; they may be normal for that patient if movement is pain free, if the patient functions well and has no distress, and if those movements are symmetrical and fall within the 4:1 ratio.

Figure 1.6 illustrates auscultation with Doppler ultrasonography. One advantage of the Doppler is that the sound is magnified, which not only helps the dentist in diagnosis but it also helps patients to understand the current condition of their temporomandibular joints. Bear in mind that a meniscus that is normal in condition and position between the condyles and the fossa produces no sound during auscultation. The surface of the normal fibrocartilege disc is smooth, and this already smooth surface is lubricated by synovial fluid. Movement across these surfaces is very quiet. Noises such as crepitation and clicks suggest changes in condition and/or position of the disc, whether or not there is pain. If the disc, either all or part, is displaced anteriorly, the functional surface now becomes the retrodiscal tissues, which are not as smooth a surface and will produce crepitation. This retrodiscal tissue has the capacity to adapt and form a "pseudodisc," which is a rougher, more fibrotic surface resulting in a higher degree of crepitation. Perforations can occur in this retrodiscal tissue in some patients, resulting in an even coarser crepitation. Functioning bone-to-bone over time can result in a hardening, or eburnation, of those surfaces, resulting in less crepitation. So a careful history is important. The patient may report that they experienced noise for a long time that eventually went away.

The implication of changes in position or condition, even without pain is instability. Instability of joint structures correlates to instability of the occlusion, an issue that both dentists and patients need to be aware of, especially if definitive occlusal and/or reconstructive dentistry is going to be part of the treatment plan.

Bear in mind that the temporomandibular joint is a ginglymo-arthrodial joint, meaning that it both hinges and translates. Structures on the medial aspect of the joint are compressed and under function during hinge rotation; therefore, auscultation during hinge rotation suggests the condition of the structures on the medial aspect of the joint. Structures on the superior and lateral aspects of the joint are compressed and under function during translation; therefore, auscultation during translation suggests the condition of the structures on the superior lateral aspect of the joint. These translation movements can be opening past 15 mm or excursive movements. Lateral pole changes are rather common, which is understandable because bruxism, which is very common, loads the superior and lateral aspects of the joints. Medial pole changes are less

common but more serious because the medial pole supports the condyle in centric hinging. Future lateral pole changes may result in more excursive interferences, whereas medial pole changes result in centric occlusion changes. Bear that in mind when designing occlusal schemes for your patient (see discussion in Chapter 4).

Figure 1.7 illustrates the superior compression test, also known as the vertical load test. This is a valid orthopedic test that suggests the load-bearing status and capacity of joint structures. The temporomandibular joints are designed to withstand firm loads without any sign of tension or tenderness.[1] Be sure to ask the patient to point with one finger to the specific location where he/she feels tension or tenderness. We want to differentiate whether that pain is coming from intracapsular structures or surrounding structures. If the discomfort is indeed coming from intracapsular structures, the patient will usually point to a spot over the temporomandibular joint area. If the patient reports tension during the superior compression tests, that may suggest hypercontraction of the lateral pterygoid muscle. Hypercontraction of lateral pterygoid pulls the condyles down and forward along the articular eminence. As the condyle is compressed vertically the lateral pterygoid is being stretched and causing a symptom of tension. If the patient reports tenderness during the superior compression tests, that may suggest edema or inflammation in or near the load-bearing areas. Either of these signs represents a condition of the temporomandibular joints that both the dentist and patient need to be aware of and that needs to be addressed before definitive treatment.

Figure 1.7. Use of bimanual guidance to superiorly compress the condyles within the fossa and test the load-bearing capacity of the temporomandibular joints.

The temporomandibular joints can be superiorly compressed in a number of different ways. One very common way is with bimanual guidance as illustrated in Figure 1.7.[1] With proper placement of the hands on the patient's mandible, a superiorly directed vector of force is created, thereby vertically compressing the condyles in the fossa. Care must be taken with hand position so that a posteriorly directed vector of force is not created. This mistake pushes the condyles posteriorly into the retrodiscal tissues and causes discomfort even if those tissues are healthy, thereby giving a false-positive result. Another method of superiorly compressing the condyles within the fossa is by having the patient bite on cotton rolls placed across the bicuspids. The contraction of the elevator muscles compresses the condyles within the fossa. Once again the patient is asked whether this produces any sign of tension or tenderness within the temporomandibular joints. A variety of premade anterior deprogrammers are available that can be used for this test. The device is fitted over the upper central incisors so that the lower central incisors strike the anterior deprogrammer at 90 degrees to its horizontal platform. Once again the contraction of the elevator muscles vertically compresses the condyles within the fossa.

After the complete examination of the TMJs, the joints are classified according to Dr. Mark Piper's classification system.[2] Piper 1 indicates a normal joint. Piper 2 indicates a joint with early changes. There may be intermittent clicking from ligament laxity and nighttime bruxism. A very mild crepitation may be heard in excursions because the lateral aspects of the disc may have signs of roughening or fibrillation. Piper 3A suggests more advanced change on the lateral pole. The lateral pole may be displacing anteriorly and recapturing and therefore there will be clicking. With Doppler, there will be crepitation if the disc is anterior; if it has moved back in to place it will be quiet. Piper 3B suggests locking of the disc anteriorly at the lateral pole. The Doppler reveals a moderate crepitation in excursions, a very common finding. Piper 4A suggests medial pole changes. The medial aspect of the disc may be displacing anteriorly and recapturing. In this case there is crepitation in hinge rotation when the disc is forward and it is quiet when the disc is in the correct position. If the medial pole is anteriorly displaced and does not recapture, it is classified as Piper 4B. There is crepitation in hinge rotation revealed by the Doppler. The author finds medial pole changes to

be rather infrequent. Piper 5A suggests a perforation and is acute and painful. Piper 5B suggests a perforation, has adapted, and is not painful. This is indicated by a rather coarse crepitation upon Doppler auscultation. A more detailed description of these stages can be found at Dr. Mark Piper's website.[2]

If the results of the temporomandibular joint examination just described suggest problems or issues, these must be addressed before undertaking a definitive treatment plan. The key point to remember is that the implication of intracapsular issues is instability over time, whether or not there are symptoms. Both the dentist and the patient need to know that instability within the joint is going to affect stability of the occlusion. Chapter 3 addresses bite splint therapy and equilibration as a way to manage these intracapsular issues.

IS THE DIAGNOSIS CENTRIC RELATION, ADAPTED CENTRIC POSTURE, OR NEITHER?

After this temporomandibular joint exam, we can make the diagnosis of either centric relation (CR) or adapted centric posture.[3] Centric relation describes a joint that is normal in structure and in which the disc is normal in shape and position on both the medial and lateral poles. This joint is quiet during auscultation and exhibits no signs of tension or tenderness during the superior compression test. Adapted centric posture describes a joint that has undergone structural changes. The condition and/or position of the disc may be altered on either the medial or lateral pole or both. This joint is generally *not* totally quiet during the auscultation exam. However, to make the diagnosis of adapted centric posture, this joint should pass the superior compression test. In other words there should be no sign of tension or tenderness during that aspect of the examination.

There are some important implications of the diagnosis of adapted centric posture as compared to centric relation. Since centric relation describes a normal joint, that joint will be much more stable over time; with joint stability comes occlusal stability. Since adapted centric posture describes a joint that is disordered, this joint typically may not be as stable over time; with joint instability comes occlusal instability. Therefore, this is a diagnosis that we need to be aware of prior to treatment, and we need to help patients understand their diagnosis and condition and the implications. With the diagnosis of adapted centric posture both dentist and patient need to know that future occlusal refinements will be necessary. If this diagnosis is not clear, future occlusal changes may be looked upon as a mistake rather than an expectation based on the diagnosis. Remember: diagnoses not excuses, and inform before you perform.

Whether or not there are structural changes within the joint, if the temporomandibular joints cannot be vertically compressed with no sign of tension or tenderness, the diagnosis can be neither centric relation nor adapted centric posture. In that case we diagnose it as a *treatment position* from which to begin treatment to resolve the intracapsular problems. The goal of therapy is to achieve either centric relation or adapted centric posture. If the joint is normal in structure and the pain (or tension) is simply from a hypercontracted lateral pterygoid or trauma that has not caused irreversible damage, centric relation is achievable. If it is a structurally disordered joint with intracapsular issues, centric relation may not be attainable, but adapted centric posture may be.

In the case of intracapsular changes, the goals of therapy are healing, remodeling, and adaptation of connective tissue and fibrocartilege as well as muscle improvement. These goals require more time than just muscle improvement, often as much as 9–12 months. Experience has shown that beginning definitive therapy too soon in a patient with intracapsular disorders can result in occlusal instability with the definitive therapy. Make sure you can achieve 2–3 months of occlusal stability on a bite splint or long-term provisionals before going to finish. A cardinal rule is to never begin definitive or irreversible therapy if the temporomandibular joints cannot be superiorly compressed without tension or tenderness.

Cases will occur in which there have been changes within the temporomandibular joints to a degree that these joints may never be able to be superiorly compressed without tension or tenderness despite the most conscientious of various treatment modalities. If this is the case, the dentist and the patient need to know at the outset about any definitive or irreversible treatment that may be needed, that total comfort may not be possible, and that long-term stability will be compromised; and both the dentist and patient need to be ready to accept the consequences.

The Muscle Examination

Muscle palpation and testing is another important aspect of masticatory system examination. Healthy, properly functioning muscles should not exhibit tenderness to palpation. Discomfort to palpation suggests issues within that muscle such as hypercontraction or

incoordination. Lactic acid buildup within the muscle could be a cause that discomfort.

There are several aspects to the muscle examination. It generally involves palpation, patient report of status of the muscles during functional movements, and—in the case of the lateral pterygoid—isometric contraction. The latter is also known as the *provocation test*. Muscle discomfort can have a variety of causes, such as medical conditions, musculoskeletal disorders, biochemical issues, etc. Occlusal interferences, especially when coupled with bruxism, can be a factor in muscle discomfort. We know from many studies[4,5] that interferences on posterior teeth during excursive movements hyperactivate the elevator muscles. Therefore, tenderness to palpation in the masseter, temporalis, and medial pterygoid suggests that excursive interferences may be a cause. We also know that interferences to the centric relation arc of closure cause a hyperactivity of the lateral pterygoid muscle. Therefore, tenderness to lateral pterygoid palpation or provocation suggests centric relation interferences.

Figure 1.8 illustrates palpation of the extraoral closing muscles. Generally, the extraoral muscles are palpated first, gloves are changed, and then the intraoral muscles are palpated. These muscle palpation tests are another good way of getting patients involved in the examination. Have patients precisely point, along with your palpation, to where the muscle discomfort occurs. Quite often only a small portion of the muscle may be painful, rather than the entire muscle. During a range of motion tests, be sure to ask

Figure 1.8. Composite picture illustrating palpation of the extraoral masticatory muscles. Using a scale of 1 to 5, ask the patient to rate any discomfort. Gently touch the patient's shoulder as a reference to compare. The pressure of a light touch will be zero.

patients to report any discomfort they may be feeling during these functional movements. Ask them to point to precisely where they feel the discomfort because it may be in muscles or joints.

Figure 1.9 illustrates palpation of the area around the lateral pterygoid muscle. The area palpated is superior and medial to the maxillary tuberosity. The muscle is too high up and back to palpate directly, but information from palpation in this area is helpful and diagnostic. After occlusal bite splint therapy, for example, this area becomes much less tender to palpation. It is not uncommon for this muscle to be uncomfortable in a big percentage of patients. Most patients have centric relation interferences, so it stands to reason that this muscle may be in a state of hypercontraction. Whether or not the patient has symptoms is another issue. Patient host resistance and adaptive capacity are factors in whether any sign will result in outward symptoms. Figure 1.10 illustrates the relationship between occlusal stressors and adaptive capacity. As occlusal stressors intensify, the chances of those stressors exceeding adaptive capacity increase, as do the chances of having outward symptoms. Bruxism can increase the intensity of occlusal stress. If the patient "doesn't do much" with those occlusal interferences, the chances of symptoms are less. Changing a patient's maximum intercuspation without a definitive end point can intensify occlusal stress. All dentists have experienced doing some simple restorations on a symptom-free patient that seem to cause a whole cycle of signs and symptoms. Occlusal stressors are not the only thing that can fluctuate. The patient's adaptive capacity can also fluctuate, as shown in Figure 1.11. If the adaptive

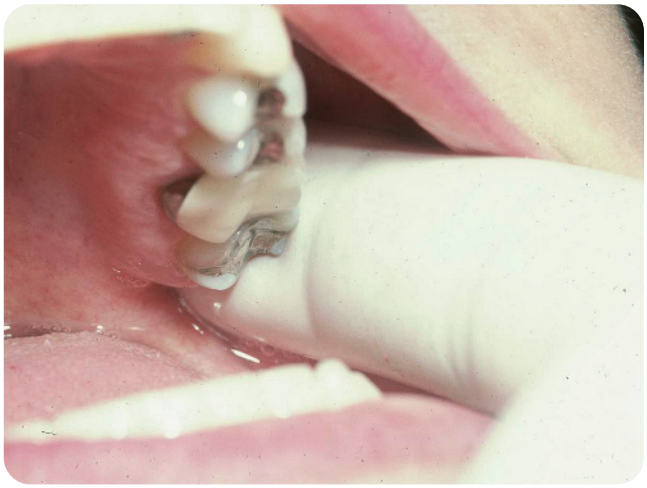


Figure 1.9. Palpation of the lateral pterygoid area is superior and medial to the maxillary tuberosity. This area is very often quite tender even to a light touch. The lateral pterygoid is commonly in a state of hypercontraction due to centric relation interferences.

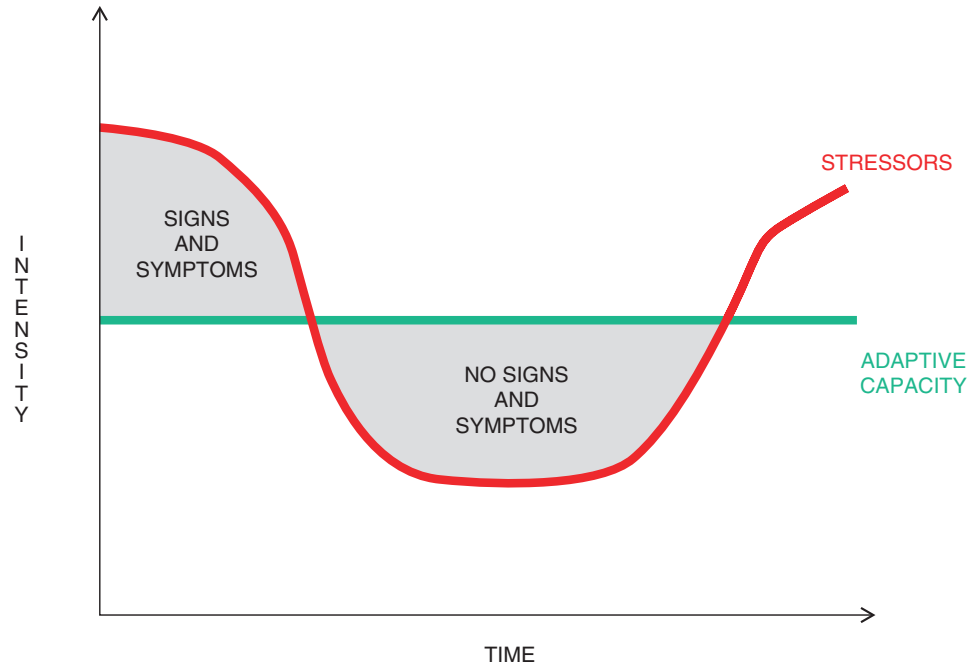


Figure 1.10. Intensity of occlusal stessors can fluctuate. If it exceeds the patient's adaptive capacity, the likelihood of symptoms is high. If it is below the patient's adaptive capacity, the likelihood of symptoms is less.

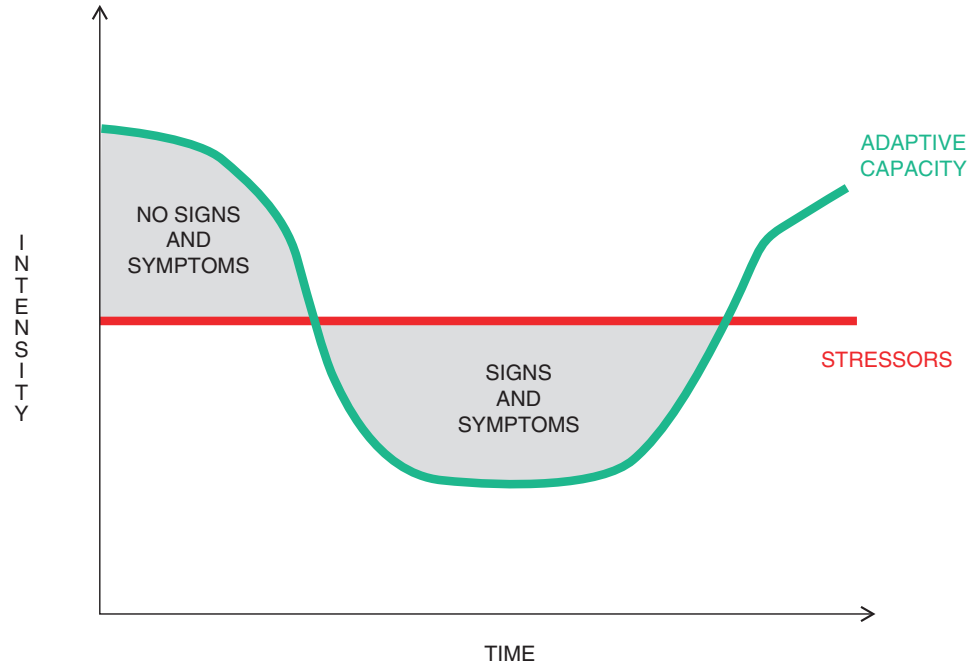


Figure 1.11. The patient's adaptive capacity can also fluctuate. If the patient's adaptive capacity is low, there may be symptoms. If the patient's adaptive capacity is high, the likelihood of symptoms is less.

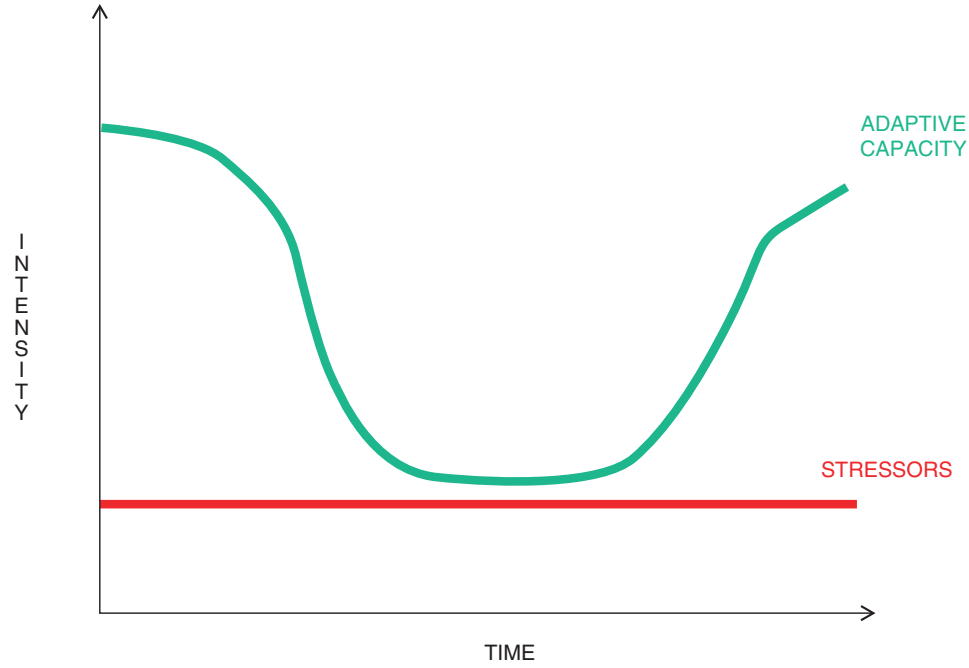


Figure 1.12. Definitive occlusal therapy can keep the occlusal stressors low enough so their level will be below the patient's adaptive capacity. The likelihood of symptoms therefore is diminished.

capacity decreases, the occlusal stressors may now exceed that adaptive capacity and the patient may be more prone to outward symptoms. There are many things that can decrease adaptive capacity. The life events that a patient experiences may be a factor as can medical conditions and illnesses. The benefit of definitive occlusal therapy is that it keeps occlusal stresses as low as possible and below the patient's adaptive capacity, as illustrated in Figure 1.12. Stable occlusal contacts in the centric relation/adapted centric posture arc of closure with simultaneous, equal intensity forces, anterior guidance on anterior teeth

with immediate posterior disclusion has been shown to achieve this. We are putting the masticatory system at a mechanical *dis*advantage and we are minimizing destructive occlusal forces.

Palpation with much less pressure than was used for the other muscles often exhibits a response that is quite painful. Many patients think that this area is uncomfortable only because it may be a tender part of the mouth, so it requires some conversation and explanation from the dentist. Figure 1.13 shows the Denar TMJ Tutor, which is an excellent communication and educational tool. Patients can easily visualize occlusal interferences, how the lateral pterygoid must contract to get the mandible to maximum intercuspation, and therefore why it may be uncomfortable to touch. The Tutor also shows how occlusal interferences can cause joint displacement, disc issues, and teeth and periodontium problems. This is just one example of how the examination should be much more than data collection; it should be an interactive process that involves the patient. An interested and involved patient is much more open to hearing our suggestions for treatment at the time of the consultation.

Figure 1.14 illustrates palpation of the medial pterygoid muscle. The reference is the pterygomandibular raphe. Palpation is medial to the raphe and the finger is moved superiorly and inferiorly to palpate as much of the length of the muscle as possible. This is another muscle that is often tender to palpation and is usually the response to posterior excursive interferences.

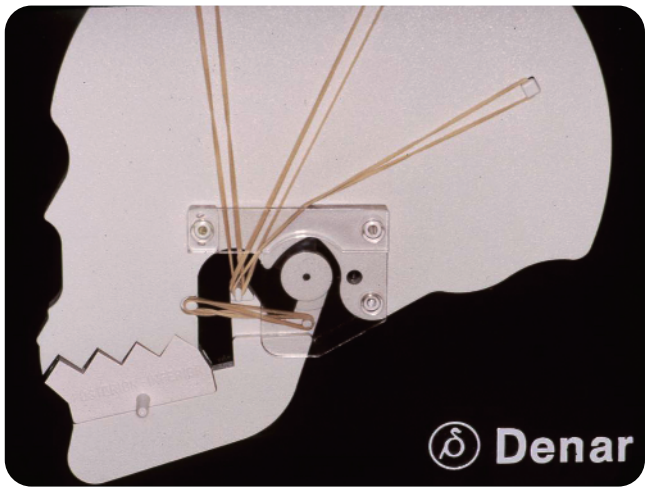


Figure 1.13. The Denar TMJ Tutor, or a similar patient education tool, is effective at helping the patient understand the status of his/her masticatory system.

Figure 1.15 illustrates the lateral pterygoid provocation test. Since the lateral pterygoid cannot be directly palpated like the other muscles can, this additional test is done to gain more information about the status of the muscle. When the lateral pterygoid contracts, it pulls the condyle down and forward along the articular eminence to protrude the mandible. Positioned in front of the patient, the thumb is gently placed on the chin and the patient is asked to protrude his/her mandible forward. As it protrudes, more resistance is applied with the thumb so that the effect is to isometrically contract the lateral pterygoid. This position is held for

Figure 1.14. By placing the fingertip medial to the pterygomandibular raphe, we can palpate the medial pterygoid.

Figure 1.15. Technique for the lateral pterygoid provocation test to isometrically contract the muscle. *NOTE:* THIS IS NOT CR MANIPULATION.

10–15 seconds and the patient is asked to report any painful or burning sensation that may be felt in the area anterior to the condyle. A muscle that is in a state of continued hypercontraction will have lactic acid buildup and become painful during this isometric contraction.[6] Any muscle, even a healthy one, becomes painful due to lactic acid buildup after an extended time of isometric contraction. Clinical experience shows that a 10–15 second test duration is enough to gain diagnostic information. It is important to note that Figure 1.15 should *not* be mistaken for the older, incorrect method of positioning the condyles to centric relation. Using this method will push the condyles down and back and into the retrodiscal tissues, which is *not* the physiologic centric relation position.

It is important to explain the rationale of the muscle palpation examination. If a patient is complaining of pain, headaches, muscle fatigue, and/or dysfunction, the rationale seems obvious. In making a diagnosis, the status of the muscles needs to be determined to rule in or out the role of muscles in the pain/dysfunction symptomatology. But what about the pain-free patient? The answer lies in what their overall treatment plan will be. If the patient is not in need of any restorative dentistry and is showing no other signs of breakdown or deterioration, this palpation exam serves as a baseline for future comparison. If the patient is in need of restorative dentistry, understanding the muscular status and bringing it to a state of health and stability will add to the predictability of the restorative result. If muscles are in a state of incoordination, even if without symptoms, it can affect the position of the condyle in the fossa. This will not be a stable, predictable, repeatable position. As a result, the position may change during the course of treatment and affect the occlusion of the restorations. All dentists have had the experience of placing the definitive restorations and being frustrated at the amount of occlusal adjustment needed. Therefore, managing temporomandibular joints, muscles, and occlusion will increase predictability and minimize frustration.

The Dental Examination

The next item in the examination is an evaluation of the status of the dentition (refer to Figure 1.2). Decay, status of restorations, structural integrity of the teeth, pulpal status, periapical status, integrity of past endodontic therapy, and integrity of posts are all noted. Digital photography is a valuable addition to the dental evaluation because it allows us to visualize tooth surfaces that are sometimes difficult clinically and to review confidently at a later time. Figure 1.16 is an example of the form used for the dental evaluation. It has a simple tooth grid to note restorations and decay, and there is space to make notes about any other significant observations.

The Periodontal Examination

Figure 1.17 is an example of the form used for the periodontal examination. Digital photography augments the periodontal examination, especially in terms of evaluating gingival levels, attached keratinized tissue, and overall symmetry and aesthetics of the gingival tissues. By assessing gingival levels as well as crevice/pocket depth, we are able to calculate the attachment level of that particular tooth. In terms of evaluating current restorations, we want to assess their gingival margins and possible recurrent decay in relation to the biologic attachment. We often need to consider gingival/osseous surgery to re-create a normal physiologic architecture and create an environment for the new restorations that is healthy, cleanable, and aesthetically pleasing.

The Occlusal Examination

The detailed occlusal examination is a very important aspect of the complete masticatory system evaluation. The purpose is not only to identify interferences but more importantly to determine whether these occlusal interferences are part of a cause-effect relationship with other signs and/or symptoms discovered during the examination. Figure 1.18 lists the signs and symptoms that are commonly observed with which occlusal interferences can be implicated. Determining this is part of the thinking and reflection that must occur after the examination. The results of the clinical exam, photographs, radiographs, and articulated diagnostic casts are studied when making this determination.

Figure 1.19 shows an example of an interference to the centric relation arc of closure. It is interesting to note that the tooth with the interference, the upper left second molar, was sensitive, had more mobility than the surrounding teeth, and had a crack on the mesial marginal ridge. Since the interference is on the facial incline of the mesiolingual cusp, the mandible must shift to the left to arrive at maximum intercuspation. It is also interesting to note that the right lateral pterygoid was more tender to palpation because that muscle had to contract more to achieve this maximum intercuspation.

NAME_____ DATE_____			
SOFT TISSUE EVALUATION			
HARD PALATE		TORI	
SOFT PALATE		PHARYNX:	POSTERIOR
CHEEKS			LATERAL PILLARS
LIPS		SALIVARY DUCTS:	PAROTID
TONGUE:	TOP		SUBMANDIBULAR
	LATERAL	LYMPH NODES:	CERVICAL
	UNDERSIDE		SUBMANDIBULAR
FLOOR OF MOUTH		ORAL CANCER EXAM	
BLOOD PRESSURE		COLOR	

DENTAL and RADIOGRAPHIC EVALUATION

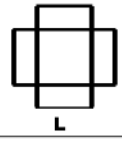
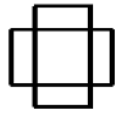
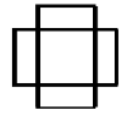
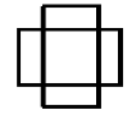
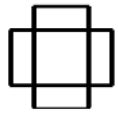
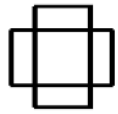
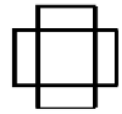
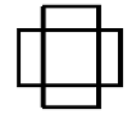
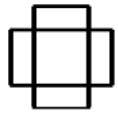
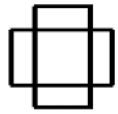
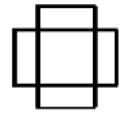
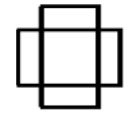
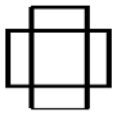
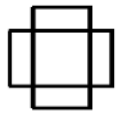
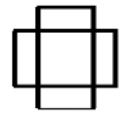
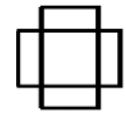
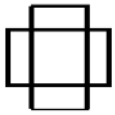
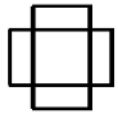
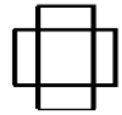
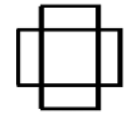
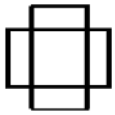
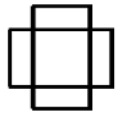
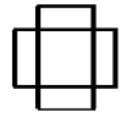
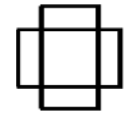
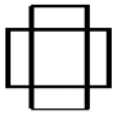
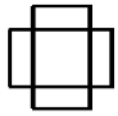
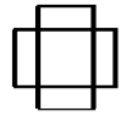
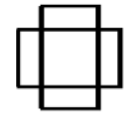
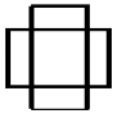
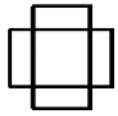
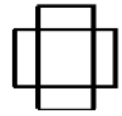
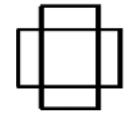
1 B  L	2 	3 	4 
5 	6 	7 	8 
9 	10 	11 	12 
13 	14 	15 	16 
17 	18 	19 	20 
21 	22 	23 	24 
25 	26 	27 	28 
29 	30 	31 	32 

Figure 1.16. Example of a form used to chart condition of the dentition. An area is available in which to make notes in addition to marking restorations and decay on the grid.

PERIODONTAL EXAM

NAME_____ **DATE**_____

POCKET DEPTH								DMM	MMD							
DISTAL FURCA																
BUCCAL FURCA																
KERAT TISSUE																
GING LEVEL																
TOOTH NUMBER	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
GING LEVEL																
MESIAL FURCA																
MOBIL																
POCKET DEPTH								DMM	MMD							

BUCCAL

LINGUAL

POCKET DEPTH								DMM	MMD							
LING FURCA																
MOBIL																
KERAT TISSUE																
GING LEVEL																
TOOTH NUMBER	**32**	**31**	**30**	**29**	**28**	**27**	**26**	**25**	**24**	**23**	**22**	**21**	**20**	**19**	**18**	**17**
GING LEVEL																
KERAT TISSUE																
BUCCAL FURCA																
POCKET DEPTH								DMM	MMD							

LINGUAL

BUCCAL

Figure 1.17. Example of a periodontal examination form.

Figure 1.18. The purpose of the occlusal examination is not only to identify interferences but also to determine whether those occlusal interferences may be a contributing factor in other signs and/or symptoms of breakdown identified during the rest of the examination.

Figure 1.19. Identification of an occlusal interference to the centric relation arc of closure. Identify the interference with marking paper but also give patients an opportunity to verbalize what they feel and identify it themselves.

Figure 1.20. With red ribbon, excursive interferences can be identified by having patients rub from side to side. Give patients an opportunity to verbalize what they feel as they rub and engage these interferences.

Figure 1.20 illustrates excursive interferences on the posterior teeth. These interferences were a contributing factor in this patient's overall mobility patterns and medial pterygoid tenderness to palpation.

The occlusal examination is another opportunity to involve the patient in the overall process. Just identifying the interferences and noting it in the patient record does nothing to elevate the patient's awareness and understanding. As these interferences are identified, patients are given an opportunity to verbalize what they feel as these interferences are engaged. Ask them to point to the area they feel contacting first. Ask them to verbalize what they feel as they contract the muscles and shift to maximum intercuspation. What about when they rub from side to side–do they feel soreness in teeth or muscles or temporomandibular joints? It does indeed take some time to slow down and allow this interaction to occur, but it goes a long way toward involving the patient, making the examination more interesting, and differentiating you and your practice from past dental experiences the patient might have had. Your attention to detail and explanations may be the determining factors that help patients decide to choose you and your practice. A visual aid such as the previously described Denar TMJ Tutor also makes these explanations much more meaningful.

A technological aid that helps with the occlusal exam and subsequent definitive therapy is the T-Scan III (Figure 1.21). Its 100 micron sensor records occlusal forces from the first contact to full closure into maximum intercuspation. The software calculates the net vector of force in real time and displays it as a

Figure 1.21. The T-Scan III is a computerized device that allows precise mapping of occlusal forces during the entire timing of closure from first contact to maximum intercuspation.

percentage right and left. The visuals displayed also allow visualization tooth by tooth along the entire time span. Figure 1.22 is a screen shot that shows one moment in time in this process. One can then correlate this visual to signs and symptoms as previously described. It is an easy-to-understand visual display for both dentists and patients. It confirms what you discovered clinically and what the patient felt and verbalized during the examination. With this kind of occlusal evaluation and patient discussion, patients will rarely object to definitive occlusal therapy. In general, if patients understand the problem and the implications of that problem, they are much more receptive during our conversations explaining various treatment options. An informed patient is a receptive patient.

The Aesthetic Examination

The last piece of the puzzle in the complete masticatory examination is the aesthetic evaluation. Aesthetics plays a role in virtually everything we do in dentistry. Aesthetics is not a separate area or specialty in dentistry but rather an integral part of the comprehensive approach. The restorations not only need to be technically, functionally, and biologically correct, they also need to be aesthetically pleasing and appropriate for that particular patient. We need to pay attention not only to the aesthetics of the individual teeth and areas that we are treating and restoring; we also need to pay attention to how the aesthetics fits into the

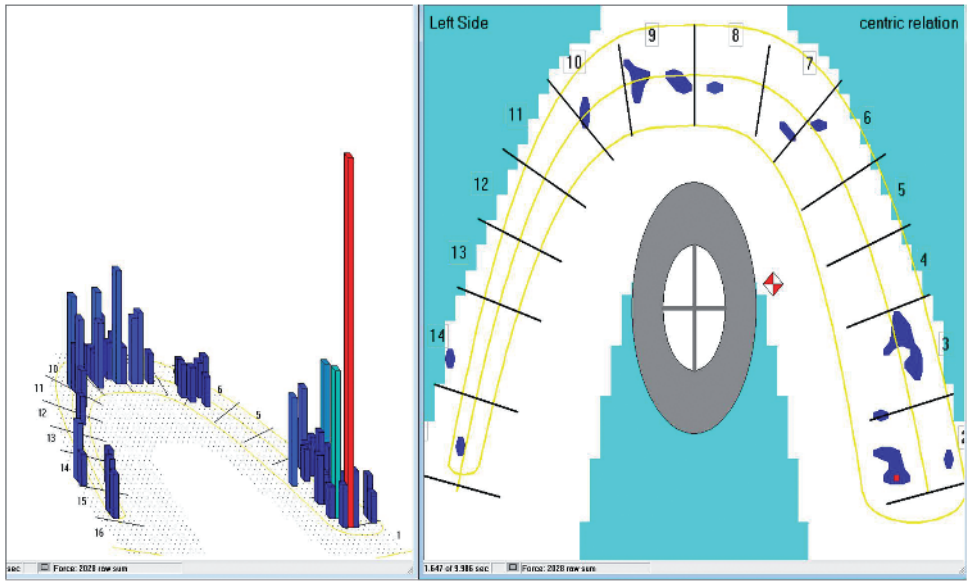


Figure 1.22. Screenshot of a T-Scan III recording.

frame of the lips and face. In other words, we need to step back and get a broader perspective. Figure 1.23 is the aesthetic evaluation form used in our practice. Parts of this evaluation can be done during the actual clinical exam. Other parts are done afterward when evaluating photographs and articulated diagnostic casts. The results of the aesthetic exam will give us important information when planning the definitive restorations in terms of incisal edge position, contours, proportions, and arrangement.

Imaging

The third component of the complete examination is imaging (refer to Figure 1.1). In this category of imaging is digital photography and radiographs, which typically are the panoramic and full mouth series. Other types of imaging may be indicated depending on the rest of the clinical examination. Questions that cannot be answered with the clinical examination, photographs, and radiographs need additional forms of imaging. For example, CAT scans allow accurate visualization of osseous architecture for dental implant treatment planning. MRIs allow visualization of both hard and soft tissues of the temporomandibular joints.

The complete digital photography series is a vital part of the complete examination and should not be overlooked. The benefits are many. You cannot diagnose what you cannot see. Digital photography helps us see better so that we can make more complete diagnoses. Photography helps patients learn about and understand their condition in a way that a handheld mirror and verbal explanations cannot. It is quite remarkable to sit in front of a computer monitor with your patients and, at the end of the examination appointment right before they leave, hand them a laser pointer as you view their photographs and then just sit back and listen! They typically will make many observations and ask many questions. Make it a point to just talk about what you see and not about treatment options. They are just beginning to learn and understand their condition—it is too soon to talk about treatment options. It is generally too overwhelming for them at this point. Give both your patients and yourself time to think, ponder, and reflect. The photographs of their teeth are the last thing they see at that first appointment. It typically makes an impact and motivates them to want to find out more. I don't agree with consultants who say you need to give patients the treatment plan at that first visit because otherwise they might not come back. Following the suggestions outlined, it is rare that patients are not interested enough to return for the consultation.

The photographic series also makes it much easier to communicate with your specialists and laboratory technicians.

It is beyond the scope of this textbook to go into the details of dental photography, techniques, and equipment. They are many good sources available for this. However Figure 1.24 shows the individual views that comprise the complete photographic series and Figure 1.25 lists the various categories and views.

AESTHETIC EVALUATION (CLINICAL OBSERVATION, PHOTOGRAPHS AND STUDY CASTS)								
NAME						DATE		
INCISAL EDGE AT REST	UPPER _____mm		LOWER _____mm DISPLAYED					
SMILE (E-SOUND)	UPPER EDGES ARE _____ BETWEEN UPPER AND LOWER LIP							
	UPPER LIP POSITION:		BELOW TIP OF PAPILLA		AT TIP OF PAPILLA			
			AT GINGIVAL MARGIN		ABOVE GING MARGIN_____mm			
	LOWER LIP POSITION		BELOW UPPER EDGES		AT UPPER EDGES			
			ABOVE UPPER EDGES		FOLLOWS SMILE LINE			
LIP FULLY RAISED	AMOUNT OF GINGIVA DISPLAYED _____mm							
MIDLINE OF UPPER CENTRAL INCISORS	CENTERED TO FACE?		YES		NO _____mm TO L / R OF CENTER			
	ORIENTATION		SLANTED		VERTICAL			
	DRAW MIDLINE AND UPPER INCISAL PLANE RELATED TO FACE IS IT AN OBVIOUS AESTHETIC DISTRACTION? Y N IS PATIENT AWARE AND UNHAPPY? Y N							
UPPER INCISAL PLANE	LEVEL?		YES		NO, SLOPES UP TO PATIENTS R L			
	REL TO UP OCCL PL		HIGHER		EVEN		LOWER	
	ARE LATS SHORTER		YES		NO			
F / V SOUND	UPPER INCISAL EDGE POSITION		AT WET / DRY BORDER					
			IN FRONT OF WET / DRY BORDER					
			BEHIND WET / DRY BORDER					
LOWER INCISAL PLANE	LEVEL?		YES		NO, SLOPES UP TO PATIENTS R L			
	REL TO LOW OCC PL		HIGHER		EVEN		LOWER	
UPPER GINGIVAL LINE	LEVEL?		YES		NO			
	ARE POSTERIORS, CUSPIDS AND CENTRALS ON SAME PLANE WITH LATERALS LOWER?							
			YES		NO			
	INDIVIDUAL GINGIVAL MARGINS							
			CURVED		FLAT		CORRECT ZENITH	
TOOTH FORM	CENTRAL INCISOR LENGTH _____mm							
	LENGTH WIDTH PROPORTION OK?				YES		NO	
	GOLDEN PROPORTION OK?				YES		NO	
	INCISAL EMBRASURES OK?				YES		NO	
	CONTOUR RIDGES OK?				YES		NO	
	LONG AXES ALIGNMENT OK?				YES		NO	
FRONTAL AND LATERAL PORTRAIT EVALUATION	ASYMMETRY							
	CHIN							
	MANDIBULAR PLANE							
	MIDFACE							
	LIPS REL TO NOSE AND CHIN							
	NEUTRAL ZONE, LIP TONICITY							
OTHER COMMENTS OR OBSERVATIONS, E.G., PATIENT CONCERNS, DESIRES AND EXPECTATIONS								

Figure 1.23. Example of a form to evaluate aesthetic parameters.

Figure 1.24. Composite of all views of a complete photographic examination. Photography allows us to see things that can be missed clinically. It allows us to go back and review at any point in the diagnosis and treatment planning process.

Category	Views
Full Face	Frontal
	Profile
Close-up	Lip at rest
Smile	Smile (E-sound)
	Lip fully raised
	Lateral smile
Retracted	Frontal in occlusion
	Frontal teeth apart
	Lateral anterior
	Right and left excursions
	Right and left crossover
Mirror Views	Buccal occluded
	Full arch occlusal
	Posterior lingual

Figure 1.25. Summary of the various views completed during a complete photographic examination.

It is a skill that the dentist and dental team can learn to seamlessly integrate into the practice.

Articulated Diagnostic Casts

The final component of the comprehensive evaluation is articulated diagnostic casts (refer to Figure 1.1). Articulated diagnostic casts give us the opportunity to visualize the maxillary-to-mandibular jaw-to-jaw and tooth-to-tooth relationships in the centric relation arc of closure. We can visualize the three-dimensional dynamics of the slide from the first contact in centric relation to maximum intercuspation as well as tooth contacts and interferences in excursive movements of the mandible. This allows us to further investigate any cause and effect relationships that may occur between various occlusal interferences and signs and/or symptoms uncovered during the clinical examination.

On a duplicate set of articulated diagnostic casts we are able to create a diagnostic blueprint, also referred to as a *diagnostic wax-up*. Any changes in form and/or function are previewed on a duplicate set of articulated diagnostic casts, and thereby you always have an original, archival set of casts to refer to as necessary.

The maxillary cast is mounted on the articulator by way of a facebow transfer. The mandibular cast is mounted on the articulator by way of a centric relation bite record (Figure 1.26). The centric relation bite record is made using bimanual guidance and at a slightly open vertical dimension, just short of the first point of contact and with the condyles fully seated into the fossa. Inspection of the articulated diagnostic casts should reveal the same first point of contact that was identified in the mouth during the occlusal examination. Inspection should also reveal the same hit and slide to maximum intercuspation that was identified during the occlusal examination. The articulated casts should slide to the same maximum intercuspation as observed with the casts held together by hand off the articulator. If not, this is a sign of an inaccurate CR record or an inaccurate mounting. A common error is observing a posterior open bite when attempting to slide the casts to maximum intercuspation. This usually is the result of the CR record capturing a slightly protruded position rather than with the condyles fully seated. The most common reason for this is a posteriorly directed force during bimanual guidance, which results in the patient resisting, contracting the lateral pterygoids, and posturing slightly forward.

The digital photographs of the various excursive movements help to set the condylar inclination on the articulator. The condylar inclination is adjusted so that the various excursive movements on the articulator look the same as the various excursive movements

Figure 1.26. Bimanual guidance is used to make a centric relation bite record. The condyles are seated and the record made at an open vertical, short of the first point of contact.

Figure 1.27. Photographs of mandibular excursions help in setting condylar inclination of the articulator. Simply adjust the inclination so that the casts look just like the mouth in the various movements.

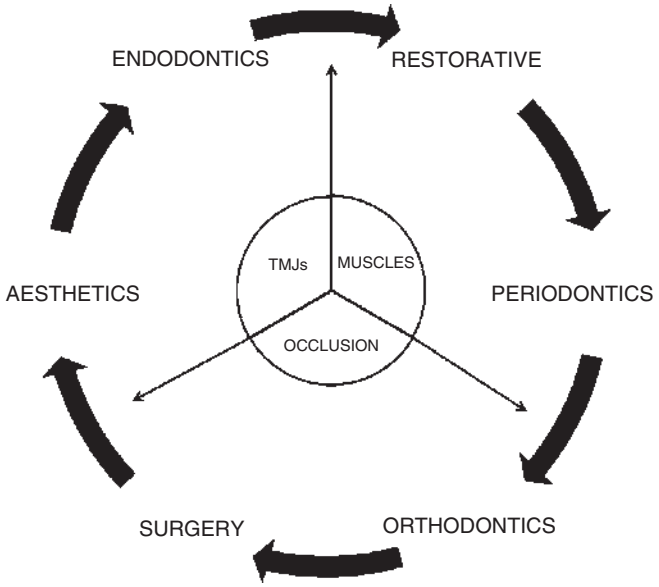


Figure 1.28. Achieving equilibrium between the TMJs, muscles, and occlusion allows more predictability with all the various types of dentistry we may be doing.

observed clinically and recorded with the digital photographs. This is illustrated in Figure 1.27. In other words, if there was a balancing interference on the left second molars during a right excursive movement, the left condylar inclination on the articulator needed to be adjusted so that this same balancing interference occurred on the articulated diagnostic casts.

A final note regarding the rationale for this comprehensive evaluation and complete masticatory system examination: By embracing this philosophy we are able to restore our patient's dentitions, both from an aesthetic and functional point of view, so that these restorations are in harmony and balance with all the components of the masticatory system. We want to design a minimal stress/minimal adaptation occlusal scheme so that we can obtain a predictable restorative/occlusal/aesthetic result that has both stability and longevity. Figure 1.28 illustrates this concept. By achieving harmony and balance between the temporomandibular joints, neuromuscular system, and occlusion, the results we get with the various disciplines in dentistry are more predictable and less frustrating. Our aesthetic and restorative dentistry lasts longer because we are controlling and directing occlusal forces. Our orthodontic and orthognathic results are more predictable because we are moving teeth and/or jaw segments with the condyles seated. Endodontic therapy and periodontal therapy heals more predictably and without significant events because we have eliminated occlusal trauma. As we broaden our scope and look beyond just fixing teeth or replacing missing teeth and begin to look at ourselves as physicians of the masticatory system, as so frequently and eloquently taught by Dr. Peter E. Dawson,[1,3] we enjoy much more happiness and fulfillment in the practice of dentistry.

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