Malocclusion, The Misunderstood Disease

A Peer-Reviewed Publication
Written by Edward D. Gardner, Jr., D.D.S.

Abstract
As general dental practitioners, we have the opportunity and responsibility to not only diagnose malocclusion, but also to have conversations with our patients to educate, motivate, and have them act on our recommendations to improve their oral health and reduce risk factors for systemic problems. Patients are often unaware of what is happening in their mouths and we as practitioners frequently do not understand the relationship between clinical signs and symptoms and malocclusion. This course will outline the consequences of occlusal disease on the dentition, and the effects of periodontal disease on common systemic health issues. The basics of an idealized occlusion will be discussed which will allow the patient to have the best function, esthetics, and health, providing a better chance for sustainability of the dentition for a lifetime.

Learning Objectives:
1. Recognize the signs and symptoms of malocclusion
2. Understand the relationship between crowded teeth, periodontal disease, and risk factors for systemic disease
3. Understand the basics of occlusion to provide patients with the very best function, esthetics, and health
4. Recognize the importance of communicating the importance of proper occlusion with our patients.

Author Profile
Edward D. Gardner, Jr., D.D.S. was raised in Richmond, Virginia where he has been in private general dental practice for 38 years. He received his Bachelor of Arts in Business Management from the College of William and Mary and his Doctor of Dental Surgery from the Medical College of Virginia, Virginia Commonwealth University. He has served as part time clinical instructor at the VCU School of Dentistry and is a member of the Academy of General Dentistry. Dr. Gardner is currently on the faculty of Align Technology and since 2005 has been presenting his Practice Integration Seminar across the United States and Canada. He has presented at the Greater New York Dental Meeting as well as the ADA national meeting. Dr. Gardner has been treating TM joint disorders for over 30 years.

Author Disclosure
The author of this course is on the faculty of Align Technology.

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Abstract
As general dental practitioners, we have the opportunity and responsibility to not only diagnose malocclusion, but also to have conversations with our patients to educate, motivate, and have them act on our recommendations to improve their oral health and reduce risk factors for systemic problems. Patients are often unaware of what is happening in their mouths and we as practitioners frequently do not understand the relationship between the clinical signs and symptoms and malocclusion. This course will outline the consequences of occlusal disease on the dentition, and the effects of periodontal disease on common systemic health issues. The basics of an idealized occlusion will be discussed which will allow the patient to have the best function, esthetics, and health, providing a better chance for sustainability of the dentition for a lifetime.

As general dentists, we have an unusual opportunity to help our patients with conditions and issues they may not know to be present and certainly do not see as a risk potential for losing teeth or for systemic diseases. When we initially interview and examine a patient making note of all conditions and symptoms present, and are trying to determine what the treatment plan will be, we should also think about what we hope to achieve. Obviously, we want the patient to be healthy, not only orally but systemically, and we know what effects an unhealthy mouth can have on the body. The entire masticatory system needs to be functional, healthy and comfortable for the patient. The teeth need to look good, and the occlusion needs to be stable and sustainable for a lifetime.

Establishing rapport with our patients is important if we are to build the trust needed to inform and educate them concerning the problems we see. When they own the problem and seek a solution, they will act on it. In many cases, however, the patient does not see or understand the problem, much less own it.

Often, we are not inclined to see malocclusion as a disease nor the implications it has for health. On initial or periodic examination, we see symptoms that are indicative of occlusal disease but underestimate the importance and deleterious effects they have for long term stability of the dentition. It is nearly impossible to have good restorative results without addressing the root causes of the clinical symptoms. What are some of the results of malocclusion we see in patients who were previously told they have a healthy mouth and need little or no treatment?

Abfraction: There is controversy as to the cause of abfractions but most dental professionals agree that occlusal forces play a role in their development. It appears that lateral forces applied to the inclined planes of a tooth cause the enamel rods at the dentino-enamel junction to fracture. Overzealous brushing can then cause these fractured enamel rods to break away from the tooth, resulting in abfractions. Patients who do not brush in an aggressive fashion can also exhibit abfractions. We can restore these areas, but after some time, they can fail, sometimes repeatedly, without any identifiable reason for the restorative failure.

Excessive wear of natural dentition: Occlusal forces that hit on inclined planes of teeth instead of in the fossa or on a marginal ridge can cause wear of enamel. This appears to be especially prominent in men that are heavy bruxers and those who have developed large masseter musculature. I have seen men in their sixties and seventies who have extreme wear of their teeth. In one instance, a male patient had only one and a half millimeters of tooth length in the mandibular incisors.

Fracture of natural teeth or crowns and bridges: This often occurs when there is no cuspid guidance and there are working and/or balancing interferences present in lateral excursions. Root fractures of endodontically treated teeth are commonly the result of these interferences.

Fracture of implants: There is nothing worse than convincing a patient to have an implant, then having the implant fail. History from the patient often shows the extracted tooth to have been broken, and then restored with a crown restoration, in many instances more than once. Prior to placing an implant and restoring it with a crown, correcting the reason the natural tooth fractured in the first place will help reduce the likelihood of restorative failure. Asking the patient a simple question can prove to be very impactful, “With the current conditions that exist in your mouth, what makes you think I can make a better tooth than the natural one you had in your mouth and that has failed?”

Sensitivity and/or soreness of teeth: Evaluation of the dentition will show the tooth to be rocking in the socket due to lateral forces on the tooth during the chewing cycle.

Splaying of teeth with loss of bone surrounding them: Can be caused by loss of posterior teeth due to periodontal conditions and/or occlusal stress.

Temporomandibular joint problems: This condition along with muscle tenderness and soreness requires that we complete a thorough TM joint examination including palpation of the joint and musculature. Other symptoms may include a history of temporal headaches, popping or clicking in the joint, pain in the joint and inability to properly chew food. It may be determined that pre-treatment of the joint is necessary before proceeding with any restorative, cosmetic, implant, or orthodontic treatment. (To be discussed later.)

Hypermobility: Occurs when lateral occlusal forces are present during excursive movements.

The signs of occlusal disease are frequently present before the patient will ever say anything to the doctor or another team member. It can be difficult to discuss these signs with the patient for fear the patient will reject our treatment recom
mendations. When the patient owns the problem and wants a solution, that is when they take action to resolve the problem. Consider starting the conversation by saying something like the following: “My job is to tell you what conditions I see in your mouth and recommend to you what can be done to correct the problem. Your job as a patient is to tell me how you want to be treated.” If a patient rejects our recommendations, we will continue to educate him/her, in hopes that the patient will better understand what is occurring and why, ultimately accepting our treatment recommendations.

How can we prevent or correct occlusal problems? When we place the teeth in a more ideal position in harmony with the action of the TM joint and muscles, it is possible to create a more stable and functional occlusion. If the joint is symptomatic or there are muscular issues, pretreatment of the joint and/or muscles may be necessary. In many cases equilibrating the dentition is the solution. If the teeth are badly worn or broken down, full mouth rehabilitation may be necessary. If there is a large discrepancy between centric occlusion and centric relation, orthodontic treatment may be necessary. Consider the use of an Essix type appliance with pivotal appliance technology to pretreat TM joint and/or muscular issues. When symptoms are eliminated and there is a repeatable, verifiable centric relation position of the mandible, clear aligner therapy can be used for the orthodontic movement. The beauty of this method of treatment is that the pivots can be placed on the aligners in the same way they were used in the pretreatment, thus maintaining centric relation throughout the orthodontic movements of the teeth (Figure 1). Because the teeth are inside the aligners, there is never a possibility of posterior working or balancing interferences during treatment. A good dental/medical history and asking the right questions will reveal valuable information about the TM joint and will also get the patient thinking about what is happening in his/her mouth, many times leading to the rehabilitative or orthodontic treatment.

Often, occlusal disease first shows up as a deep bite with slight wear of the mandibular incisors (Figure 2). If the disease is left untreated, additional wear on these teeth appears with some cupping out of the dentin on the incisal edge. The typical solution has been to restore the incisel edge of the incisors, but in almost every instance, these restorations will fail as the incisors continue to wear. Over time, the bite closes and extreme wear of the mandibular incisors occur with the palatal aspect of the maxillary incisors wearing thin. This often results in dentinal exposure and weakening of tooth structure. When is the appropriate time to begin discussion of these possible consequences? Should it not be when the patient is initially examined and early symptoms start to appear? Beginning a conversation at this time, about causes and solutions is appropriate. Many times the patient will respond to questioning about the wear with comments such as, “I have had this wear for years and no one has ever said anything about it.”

We must also consider the periodontal aspects of malaligned teeth and the risk factors it presents for systemic diseases. A study in the January 2004, Journal of Orofacial Orthopedics showed that “anterior crowding greater than 3mm as an individual host factor represents cumulative risk potential for chronic inflammatory processes.” In another study in the International Journal of Orthodontics and Orthognathic surgery, “it was concluded that (1) more plaque accumulated in crowded areas; and (2) more species of perio pathogens were present in the subgingival plaque of crowded area.” This indicates that more pathogens and therefore more toxins are present and more likely to enter the bloodstream through the capillary beds subgingivally. It was reported in the ADA News, February 2012 by Dr. Yiping Han, Case Western School of Dental Medicine, that Fusobacterium can open a door in human blood vessels allowing it and other bacteria to infiltrate the body and cause disease. Other studies show the connection between periodontal disease and memory loss. In an article in the October, 2007, JADA, The Nun Study, points out the connection between periodontal disease and diabetes. In Current Opinions Endocrinol Diabetes it states, “evidence suggests that periodontal therapy is associated with improved glycemic control in many patients with both diabetes and periodontal disease.” This study seems to suggest that a conversation between dentist and patient is advised when the patient’s medical history shows diabetes or a pre-diabetic condition. This conversation should be centered on straight teeth and biofilm control, thus reducing the chance of periodontal disease.

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between oral bacteria and its effects on the brain, “Potential mechanisms include inflammatory mediators produced in response to periodontal pathogens which produce chronic systemic inflammation and neuropathology: increased risk of stroke and cerebrovascular injury in those with periodontal disease, and dissemination of oral gram-negative bacteria to the brain via a transient bacteria. Oral bacteria also may spread to the brain via neuronal pathways. Riviere and colleagues suggested that oral bacteria may use branches of the trigeminal nerve to reach the brain.” People in their fifties, sixties and beyond likely want to know and do all they can to prevent or at least delay dementia and/or Alzheimer’s disease.

An article in the December, 2011 AGD Impact stated a “bacterium typically associated with periodontal disease may be linked to higher cases of colon cancer,” according to two studies published on October 18, 2011, by Genone Research. The two studies, conducted by U.S. and Canadian scientists, found abnormally high numbers of Fusobacterium in tumor samples collected from colorectal cancer patients compared with tissue samples from healthy patients. Though both studies were unable to determine this bacterium’s contribution to colon cancer, the studies did reveal that this anaerobic, proinflammatory bacterium, like other bacteria and viruses, may be linked to malignancies and other infectious diseases. How important is this information? Should we not be having conversations with our patients about the ramifications of malaligned teeth and possible consequences of periodontal disease before the onset of problems?

With all the research that has been conducted and with further research results being reported regularly, it becomes clear that straight teeth and a good occlusion are very important to overall health. I have observed and am sure that most general practitioners will agree that straight teeth are easier for both the hygienist and the patient to clean and maintain. Orthodontic treatment, especially the use of clear aligners is among the services offered in many general dental practices. The majority of patients treated are usually adults and who would not consider traditional wire and bracket procedures. It is not uncommon for patients to say, “this is the easiest cleaning I have ever had” after clear aligner treatment is completed. Most of the cases come straight from the hygiene chair, especially in general dental offices with a well designed periodontal treatment protocol. It is quite common for dental practices to experience a steady source of new patients by those satisfied with the results achieved.

What are the basics of occlusion that will allow us to provide patients with the very best function, esthetics, and health?

The starting point is centric relation and not centric occlusion. As Peter Dawson says in his book, Functional Occlusion, “centric relation is the only condylar position that permits an interference-free occlusion.” If this is our beginning point, then we need to know what is occurring within the joint itself. I find Mark Piper’s classifications of TM joint dysfunction and Peter Dawson’s classifications of occlusion very helpful in determining the diagnosis and what treatment should be prescribed for each patient. Without a proper diagnosis of what exists in the joint, muscles, and teeth, any attempt at correction of occlusal problems and its symptoms could be futile. If there are joint or muscle issues, they must be addressed first. Assuming, however, that the patient is a Dawson Type I or IA and a Piper Stage I (In a Dawson Type I, centric relation and centric occlusion are the same position. In Type IA, an adapted centric relation and centric occlusion coincide. With Piper stage I, the joint is healthy and functions normally), what are the guidelines we must adhere to if we are to correct a malocclusion and eliminate the causes of the symptoms we have previously discussed?

From this centric relation position of the mandible where the muscles are able to function in the way they were intended, there can be no working or balancing interferences when the mandible moves in a lateral excursion or when the mandible moves forward. In other words, ideally, there needs to be a definite cuspid rise or at least good group function. Anterior guidance within the envelope of function also is needed as it is one of the determinants of a healthy occlusion. I tell patients that this combination of cuspid rise and anterior guidance is like a curbing on a street. The curbing is not there for you drive against but to drive within. As long as you stay within the curbing, you will be okay. If you were not paying attention while driving and you hit the curbing, it would wake you and remind you to drive within the curbing. And if the curbing were not there and you were not paying attention, you could drive off the road and injure yourself or someone else. The point is that these determinants are our curbing. They are there for a reason, that is to protect our back teeth and allow us to function without giving a thought to the safety of our teeth. So anterior teeth protect the posterior teeth as long as the posterior teeth disclude the moment either condyle starts to move from its fixed centric relation condylar position. This allows the muscles to fire when they are meant to fire and relax when they are meant to relax. Otherwise, there will be muscle activity which is counterproductive to maintaining a healthy, functional, and sustainable dentition.

Another key ingredient is that the posterior teeth in maximum intercuspation in centric relation should only contact on cusp tips and fossas/marginal ridges and there should be contact on all teeth. As soon as the mandible is moved into any other position, the posterior teeth should immediately disclude. In this way, forces are only applied in a vertical direction and there is no lateral torque on any posterior tooth.
Figure 4. Centric stop on all teeth and ideal arch form

The more ideal arch form that we are able to attain, the better the result we can achieve. The best arch form is U-shaped and this form begins in the anterior segment. When treatment planning for aligner therapy, the maxillary incisors should be in golden proportion. That is, when viewing the anterior six teeth from the anterior view, the central incisors should appear 1.6 times the size of the lateral incisors in their width and the mesial third of the canines should appear .6 times the size of the laterals. If the laterals are too small, then the arch form will tend to be V-shaped. If the laterals are too large in relation to the centrals, then the arch will be too squared. This proportion also has an impact on the position of the canines which has a direct relationship to cuspid rise. Without cuspid rise, the possibility of balancing interferences is greatly increased, potentially increasing symptoms. In addition, for ideal arch form, the premolars and molars should step back in equal proportion when seen from anterior view. This is better known as the buccal corridor and it can be controlled in planned orthodontic movement with aligner therapy.

In optimum function, the lower arch should have a proper curve of Spee and curve of Wilson, together known as the plane of occlusion. This curvature of the mandibular arch is crucial to allow for the posterior teeth to disclude during excursive movements and avoid lateral forces on the posterior teeth.

The last key ingredient to a healthy and functional occlusion is the incisal edge position. When having a patient say “fifty five”, the incisal edge of the maxillary incisors should lightly touch the inner vermilion border of the lower lip when speaking softly, gently allowing the facial muscles to be more relaxed. This incisal edge position is not only important for proper anterior guidance but also for making a great smile. Too low an incisal edge position makes for a gummy smile and too high does not show enough tooth. A hint of gingival tissue should appear in a full, healthy, youthful smile.

Figure 5. Notice how the premolars and molars on both sides step back in equal proportion behind the canines. This allows for an ideal U-shaped arch form.

Figure 6. Talking with patients about these issues may mean we have to start looking for conditions and symptoms that we have not previously seen. We will be able to achieve enhanced results for our patients and have a patient base that is truly trusting and regularly referring family, friends, and business associates to our practice for their dental needs.

References
3. ADA News, February 2012, Article by Jean Williams, Research by Yiping Han, “Common oral bacteria breaks into blood stream to infect organs.”

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Questions

1. You have talked to a particular male patient repeatedly about his malocclusion, yet he does not comply with treatment recommendations. What is the main issue with this patient?
   a. He knows he has a problem but it is not significant to him.
   b. He understands the issue but cannot afford to have it treated.
   c. He has no ownership in the problem.
   d. He wants to wait until it bothers him.

2. What are the symptoms of malocclusion?
   a. Abstractions
   b. Increased salivary flow
   c. Excessive wear of natural dentition
   d. All and above

3. Lateral forces applied to inclined planes of teeth cause many issues that are often overlooked by the clinician. Which of the following conditions are a result of lateral forces being applied to teeth?
   a. Excessive wear of teeth
   b. Hypersensitivity of a tooth
   c. Fracture of porcelain on a crown
   d. All of the above

4. What are the symptoms that would indicate the TMJ should be treated prior to any restorative, orthodontic, or equilibration therapy?
   a. Temporal headaches
   b. Pain in one or both joints
   c. Clicking in the joint
   d. All of the above

5. A 50 year old patient is seen in your office for his six month recall appointment. On examination he shows abrasions on tooth numbers 3, 4, and 6. What best explains these conditions?
   a. Brushing too hard
   b. Using an abrasive toothpaste
   c. Restorations not properly placed
   d. Fracture of enamel rods at the DE junction

6. You placed a 3 unit PFM bridge 5 years ago on teeth 3, 4 and 5, with #4 as the pontic. The patient presents with a porcelain fracture off the palatal cusp of the pontic. What is the most likely cause?
   a. The bridge is too high in occlusion.
   b. Bubble in the porcelain when fired by the lab.
   c. Fracture of porcelain on a crown
   d. All of the above

7. On initial examination of a 28 year old male patient, you observe mild wear of the incisal edge of the lower incisors. There is no joint involvement but the right masseter muscle has a tender trigger point. When placed in centric relation, there is 1mm slide forward to centric occlusion. The best treatment option in this case is to:
   a. Give the patient a prescription for a muscle relaxer.
   b. Place the patient in an upper night guard.
   c. Restore the incisal edges of the mandibular incisors.
   d. Equilibrate the dentition.

8. A 40 year old female calls your office and asks to be seen because she is unable to open her mouth in the morning. She relates that when she first wakes up, her jaw feels stuck, then there is a loud pop on one side and from that point she can open the rest of the day without difficulty. What is your best advice to her?
   a. Take an anti-inflammatory before going to bed.
   b. Place heat on the side of the joint before retiring.
   c. Take a muscle relaxer.
   d. Place the patient in a mandibular pivotal appliance.

9. A seventy year old male patient is seen in your office for routine six month examination and cleaning. You have seen him for the last 20 years and have noticed the severe wear of all of his teeth especially the shortness of the mandibular incisors. What conversation should occur between you and the patient?
   a. You look fine, nothing has seemed to change.
   b. Are you having any problems? If you do let me know.
   c. You need full mouth reconstruction to restore your mouth.
   d. Can I take study models of your mouth, evaluate your oral conditions, and then determine the best approach to treatment?

10. The biofilm that accumulates on crowded and straight teeth is different. Which of the following is true regarding the potential risk this presents?
    a. The bacteria enters the body through the saliva and is swallowed.
    b. The bacteria travels from the mouth by neuronal pathways.
    c. The bacteria and toxins enter the bloodstream and are disseminated.
    d. Answers b and c

11. Periodontal disease has been linked with several systemic diseases. Which of the following conditions have linked to periodontal disease?
    a. Colon cancer
    b. Diabetes
    c. Dementia
    d. All of the above

12. A patient you have treated previously with multiple units of crown and bridge returns to your office for her 6 month cleaning and examination. The occlusion looks good, the margins and porcelain are intact but she complains about temporal headaches on the right side that she had never had before. What is the most likely cause of this symptom?
    a. There is discrepancy between CR and CO with a slide.
    b. The bite appears too open
    c. There is no cuspid rise on either side
    d. All of the above

13. Adequate cuspid rise is important for which of the following reasons?
    a. It eliminates working and balancing interferences.
    b. It creates good cusp to fossa relationships.
    c. It eliminates balancing interferences only.
    d. None of the above

14. An implant has been placed in the number 31 area and restored with a standard abutment and total zirconia crown. The implant has been in place for 5 years and appears to be functioning properly. Suddenly the implant has broken at the fixture level. What is the most likely cause?
    a. Monoplane occlusion on the crown.
    b. Defect in the implant fixture.
    c. Poor placement of the implant.
    d. Lateral torque placed on inclined planes of the crown during excursive movements.

15. After successfully treating a TMJ patient with appliance therapy, why would treatment with traditional orthodontics with wires and brackets not be appropriate?
    a. The patient has become used to clear appliance therapy and does not want traditional brackets and wires.
    b. Working and balancing interferences can occur during treatment and thus unseat the condyle during treatment.
    c. It is nearly impossible to maintain centric relation during treatment.
    d. All of the above

16. Curve of Spee and Curve of Wilson are important for several reasons. One of these reasons is:
    a. To maintain the proper vertical dimension.
    b. To insure there is good cusp to fossa contact between upper and lower teeth.
    c. To allow the maxillary and mandibular teeth to move in and out of each other thus helping to eliminate interference during excursive movements.
    d. None of the above

17. Golden proportion in the maxillary anterior incisors is important because:
    a. It allows posterior teeth to function in cusp to fossa.
    b. It sets the shape of the arch.
    c. Is not important because arch form is not important to how the teeth occlude.
    d. None of the above

18. After determining the correct golden proportion, having the premolars and molars step back in an equal fashion behind the canines is important because:
    a. It fills the buccal corridor.
    b. It makes the smile appear more youthful.
    c. It gives the arch the proper U form.
    d. All of the above

19. Golden proportion is important because of the position of the canine. Which statement is true concerning the lateral incisors?
    a. If they are too small, the arch will be more square shaped.
    b. If they are too large, the arch will be more “V” shaped.
    c. The size of the laterals makes no difference in arch form.
    d. Appropriate space should be provided for the proper size of the laterals in orthodontic treatment.

20. Incisal edge position of the maxillary incisors is important because:
    a. Must be appropriate.
    b. To insure there is good cusp to fossa contact.
    c. Is not important because arch form is not important to how the teeth occlude.
    d. All of the above

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Educational Objectives

1. Recognize the signs and symptoms of malocclusion
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