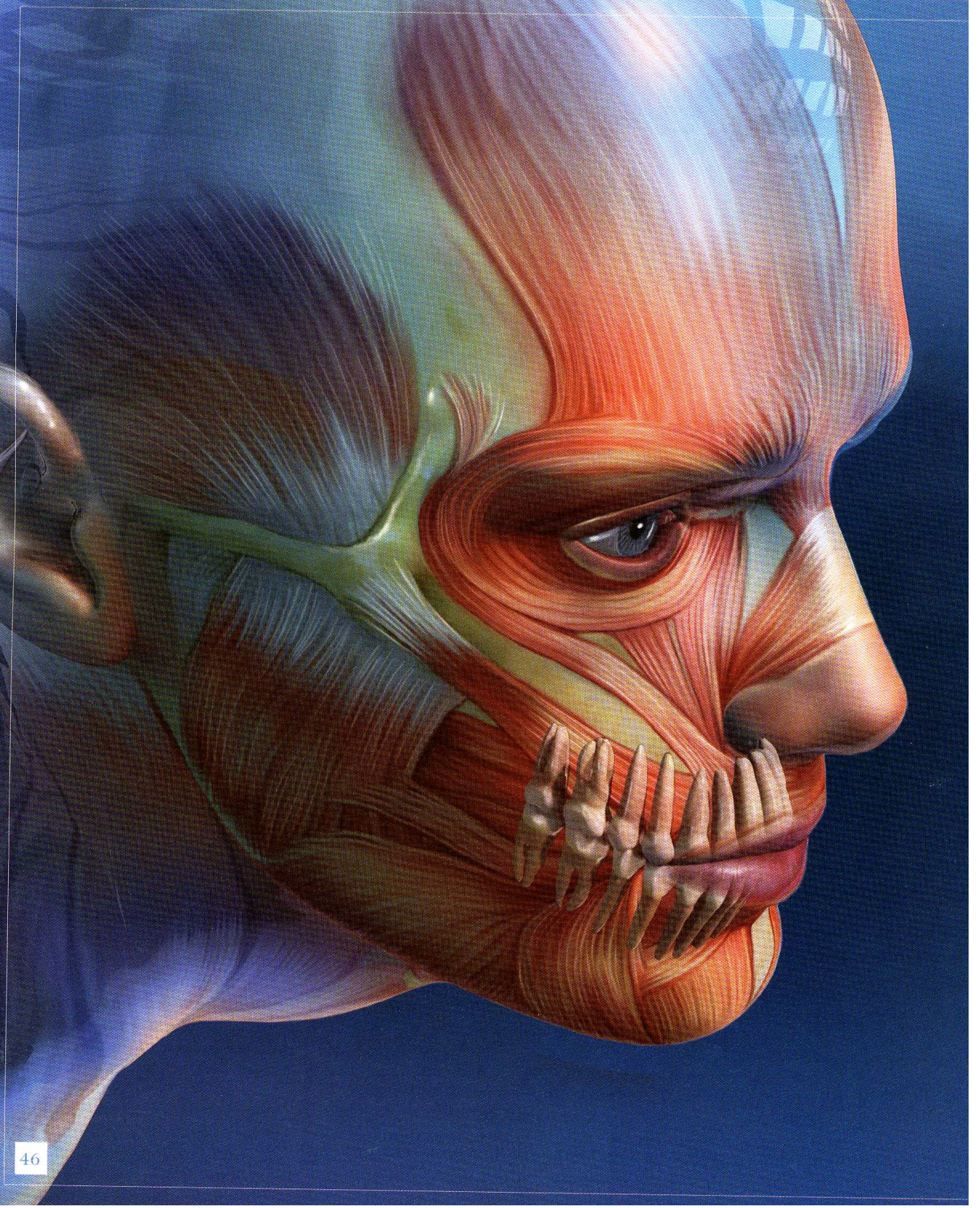


Understanding Occlusion

Frustration and confusion still reign over this complicated topic, but experts agree that the differing philosophies of occlusion are slowly finding common ground.

For more than 100 years, dentists have debated the role of occlusion in dental practice. Unlike most aspects of dentistry, there is a lack of unified theory and practice regarding occlusion. In fact, the very definition of the term has been a source of contention. The result has been that occlusion is associated with a great deal of dogma and division into "camps" of different occlusion philosophies. The camps have changed somewhat over the years, but the debate—some would say controversy—over occlusion has remained.

Five years ago, *Inside Dentistry* investigated the occlusion controversy in dentistry.[1] Revisiting the topic of occlusion today, it is apparent that although some divisive aspects of the debate remain, some of the differences have narrowed. We interviewed a group of occlusion experts to gain insight about the current state of occlusion. The good news is that although divisions still exist, there appears to be a less dogmatic approach and a greater willingness to concede that no single philosophy works for all cases.

Jackie Syrop

Yes, there is still "occlusion frustration," but proponents of the main occlusion philosophies agree on larger issues: the importance of occlusion in dentistry and the acknowledgment that only a minority of dentists are educated about occlusion in their practices; the negative effects of not considering occlusion; and the need for solid postgraduate training in occlusion. There are still differences of opinion about which occlusion philosophy and training should be embraced, but some of our experts espouse a more inclusive approach to occlusion philosophies that acknowledges the possibility that more than one way can work.

Finally, the occlusion experts were unified in hoping to see more emphasis on effectively integrating occlusion into dentistry as the next generation of dentists comes into its own.

Defining Occlusion

In discussions of this nuanced subject, even the definition of occlusion isn't cut and dried. "Unfortunately, the definition of occlusion can range from the static 'way teeth fit together' to what people do with their entire system: vital functions, such as chewing, breathing, speaking, swallowing, and parafunctional behaviors," says John Kois, DMD, MSD, director of the Kois Center in Seattle, Washington.

The narrow definition of occlusion—how the teeth fit together—helps create some of the confusion we see today, says Jim McKee, DDS, a dentist in private practice in Downer's Grove, Illinois, and a visiting faculty member at the Piper Education and Research Center in St. Petersburg, Florida. "If we were to talk about occlusion in terms of how the mandible fits to the maxilla, it would allow us to have a conversation that focuses on both the front end of the system—the teeth—as well as the back end of the system—which is the TM joints," he notes. Dr. McKee points out that if we always talk about occlusion relating only to the teeth, it is a problem, because bite forces aren't only transferred to the teeth, they're also transferred to the temporomandibular joints (TMJs).

Most dentists who have studied occlusion in depth concur that any definition of occlusion should not be limited to tooth-contact relationships, but rather should take into account the dynamic morphologic and functional relationships among all components of the masticatory system—not just teeth and supportive tissues but also the neuromuscular system, TMJs, and the cranioskeleton.[2]

It is beyond the scope of this article to explain details about individual occlusion philosophies, or to come to definitive conclusions about their pros and cons. But to understand the roots of occlusion frustration, it makes sense to present summations of what of our occlusion experts consider to be the main philosophies of occlusion so that we are—as much as possible—speaking the same language.

Why is Occlusion Important?

"Occlusion is the 'big picture' in dentistry," explains Dr. McKee. "It's the most important discipline in dentistry that there is to learn." As he explains, there are two root causes for most dental problems: bacteria, which lead to decay or periodontal breakdown, and bite forces. "Occlusion needs to be evaluated in every patient, just as we evaluate other areas of the system," he says. "It impacts every dentist's and every specialist's practice."

Whichever occlusion philosophy dentists follow, the bottom line is that they all believe that occlusion underlies all dentistry. "Creating a stable occlusion of the dentition

continued on page 49

PHILOSOPHIES OF OCCLUSION

CENTRIC RELATION:

Uses the temporomandibular joint (TMJ) as a reference position from which to build occlusion. When the teeth fit together, the joint should fit completely in its socket. Centric relation (CR) proponents believe it is most important to structure the condyle/disk/fossa assembly to distribute the bite forces more evenly, but vary in how to determine CR and how to achieve it.

Note: Within the CR category, there are several "schools," including the gnathologic and bioesthetics philosophies. Gnathologic uses CR in the intercuspal position along with canine guidance. The amount of anterior overbite/overjet is related to the TMJ. Bioesthetics uses specific anterior tooth size and specific overbite/overjet to develop occlusion that would, proponents say, prevent bruxism, wear of the back teeth, and damage to front teeth. Like gnathology and bioesthetics, the Pankey and Dawson schools use CR for intercuspal position to build occlusion in CR but differ in ways of addressing front teeth and overbite/overjet.

helps provide a healthy masticatory system," explains Michael R. Sesemann, DDS, a dentist in private practice in Omaha, Nebraska. A healthy masticatory system is an effective chewing machine and has long-term stability because it effectively manages functional forces, he says. But he cautions that as dentists make changes to the system through dental restoration, they have to do it in a way that ensures harmony of its essential elements: a stable TMJ, a physiologically balanced musculature, a structurally strong dentition, and a healthy periodontium. If that is not done, the problems that ensue could include breakdown and failure of any one, or all, parts of the masticatory system.

"Occlusion matters because our physiology dictates it," says William G. Dickerson, DDS, founder and chief executive officer of the Las Vegas Institute for Advanced Dental Studies (LVI), in Las Vegas, Nevada. Our teeth occlude thousands of times a day, and proprioceptive input is sent to the brain from the periodontal ligament through the trigeminal nerve. With more than half of the total neural input to our brain coming from the trigeminal nerve, he says, nature has clearly placed a great deal of importance on the sensory information from this region. "If the occlusion is not balanced and in harmony, an avoidance reflex develops to prevent injury from noxious input," says Dr. Dickerson, and if the noxious stimulus is chronic, such as occlusive interference from a "high" filling or crown, the reflexes designed to protect become harmful. Chronic avoidance reflexes can affect the posture of the jaw, the head, neck, and body, leading to fatigue and chronic pain. "Eliminating interferences in function is a critical part of understanding occlusion," Dr. Dickerson concludes.

ELIMINATING INTERFERENCES IN FUNCTION IS A CRITICAL PART OF UNDERSTANDING OCCLUSION.

Occlusion is important because dentists use it to help maintain their patients' teeth by controlling the forces placed on them, says Glenn E. DuPont, DDS, who practices in St. Petersburg, Florida, and lectures at the Dawson Academy. Certain forces are extremely detrimental to particular teeth or the whole dentition, causing teeth to break, wear out, or get loose, and leading to general discomfort, headaches, muscle pain, and TMJ inflammation and discomfort.

CONFORMATIONAL OCCLUSION:

Not so much a philosophy itself, conformational occlusion makes everyone's list simply because so many dentists practice conformational dentistry and don't follow one of the other theories. A conformational occlusion approach basically allows patients to function with whatever bite they currently have. Experts pointed out that this may be appropriate as long as there are no problems with the occlusion, but if there are problems, the dentist is forced to choose between building into an occlusion with known instability or to use one of the other theories.

NEUROMUSCULAR-BASED OCCLUSION:

Uses the muscles of mastication as a point of reference. Dentists use electronic stimulation of muscles with an electromyogram to find the most relaxed state, and in this position, resting muscle length will determine condylar position. The role of the trigeminal nerve is important. This school of thought says that when the muscles are in physiologic harmony, the patient is not coping with pathologic muscle forces and you can create long-term bite stability.

JOINT-BASED OCCLUSION:

Uses the condition and position of the condyle and disk within the glenoid fossa to determine condylar position during maximum intercuspation. Unlike CR, joint-based occlusion does not assume that the joint is structurally intact. TMJ imaging using magnetic resonance imaging and cone-beam computed tomography is performed to evaluate dimensional changes in the joint.

TABLE 1

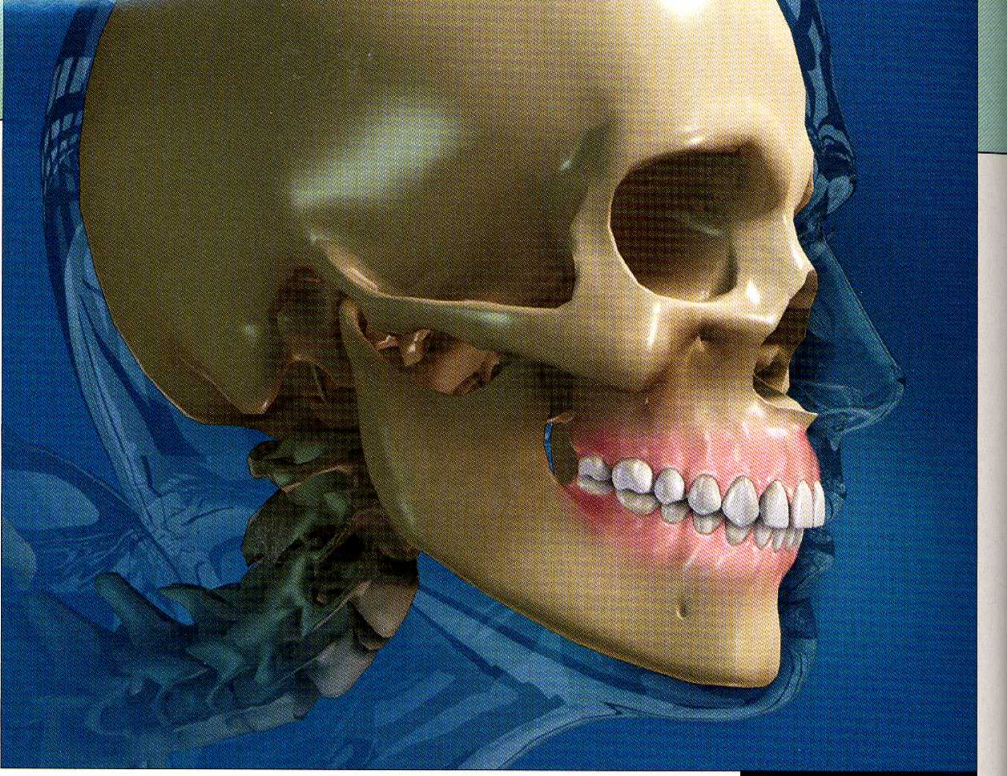
How Poor Occlusion Affects the Dentistry You Practice

Poor occlusion that does not effectively control functional and parafunctional forces on the teeth can cause a wide variety of problems:

- Broken teeth
- Worn teeth
- Loose teeth
- Bone loss
- Sensitivity
- Shifting teeth
- Discomfort
- Headaches
- Muscle pain/chronic pain
- Temporomandibular joint inflammation and discomfort
- Fractures in restorations
- Obstructive sleep apnea (iatrogenic)
- Exostosis, abfractions

Potential causes of occlusal problems include:

- poorly done orthodontics.
- improperly adjusted crowns/fillings.
- mismatched jaw size and teeth.
- poor diet during growth.
- cosmetic dentistry done without complete understanding of occlusion.
- stress and anxiety that lead to increased forces on the teeth (eg, habitual clenching and/or grinding).



CONFORMATIONAL

Any dentistry done for a patient that does not fit into a well-designed or adjusted occlusion has the potential to result in these same problems, cautions Dr. DuPont. Table 1 describes the potential causes and consequences of malocclusion.

"In some patients, occlusion probably doesn't matter very much, while in others it is critical," says Frank M. Spear, DDS, MSD, a periodontist/prosthodontist and founder/director of Spear Education in Seattle, Washington. "One of the biggest challenges of occlusion is that, unlike most things we do in dentistry, occlusion is not at all predictable. Some patients have significant malocclusion and have no symptoms whatsoever but are fine; others seem to have ideal occlusions but have symptoms, pain, or signs of tooth grinding," he says.

By improving a patient's occlusion, you are not only improving the longevity of the patient's own teeth, but you also improve the longevity of your dentistry, Dr. Kois explains. Although we have come to accept significant wear on teeth as being a "normal" adaptation, people are adapting at accelerated rates because of compromises in occlusion. If we can learn to harmonize occlusion, from even a younger age, the rate of adaptation would be slowed down and the compromises people have to live with would not be the same.

Fundamental, Yet Rare in Practice

One of the most difficult things to explain is the fact that although all the experts with whom we spoke consider occlusion to be absolutely fundamental to all dentistry, only a small percentage of practicing dentists have a significant knowledge of the subject or effectively use occlusion in their practices.

Teasing apart the reasons behind this discrepancy reveals important clues as to why there's so much controversy about occlusion: occlusion is controversial because there is no unified theory and there's no agreement because there are too many controversial elements. Occlusion isn't studied in dental school because there is no definitive approach, which makes it impossible to teach within a 4-year curriculum. The most cited reasons for the small number of dentists practicing occlusion dentistry follow.

Complex Subject Matter

Dentists who embrace occlusion believe that it underlies everything dentists do, but the fact that occlusion is so basic does not negate how complex and difficult a subject it is. "The execution of many of these

A SIGNIFICANT NUMBER OF PATIENTS HAVE UNRECOGNIZED STRUCTURAL DAMAGE TO THE TMJS.

protocols is very difficult to master," Dr. Kois acknowledges. A lot of dentists don't feel confident about occlusion, particularly newly practicing dentists.

Misinformation

Dentists have also been scared away from adjusting the occlusion because of misinformation, states Dr. DuPont. The National Institutes of Health has contributed to the confusion with its publication for patients that advises them not to allow dentists to adjust their bite because it may cause a TMJ problem, he says.[3] The same publication states that occlusion is not related to TMJ problems, which Dr. DuPont terms "ridiculous" and in contradiction to every tenet of evidence-based research.

Success Practicing Conformative Dentistry

Most dentists see little reason to learn more about and use the principles of occlusion because conformative dentistry is working for them. "Most people walking around do fine with whatever occlusion nature gave them, and nature doesn't generally create an occlusion in centric relation," Dr. Spear points out. It's only when you need to treat a lot of teeth, or the patient has muscle or jaw joint symptoms, that occlusion becomes an issue.

Dr. Sesemann agrees. "Dentists can have good restorative knowledge and not much occlusal knowledge and be able to do many things in dental practice," he says. "But if they need to do something outside of the patients' adaptability, that's when complex issues can arise."

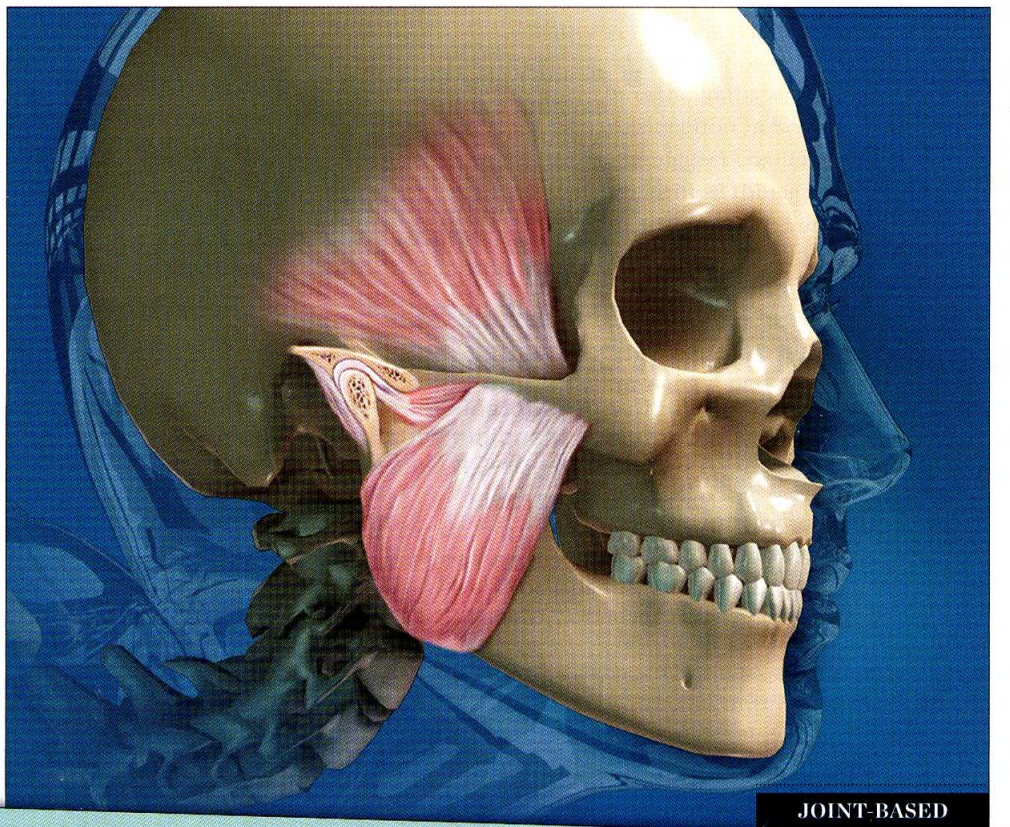
Lack of "Hard" Science

Critics maintain that there is no real science supporting the various occlusion philosophies. Dr. Dickerson points out that neuromuscular occlusion dentistry uses electromyography techniques to measure neurologic and muscular physiology. This helps quantify the best neutral, balanced, and rested position of the muscles, which helps to reach a physiologic state from which the best position to build the bite will be in harmony with that patient's physiology. Still, there aren't double-blind, randomized clinical trials in occlusion that would provide solid evidence upon which to base decisions about occlusion treatments. "The science is still trying to refine and resolve so many issues pertaining to the human system," says Dr. Kois.

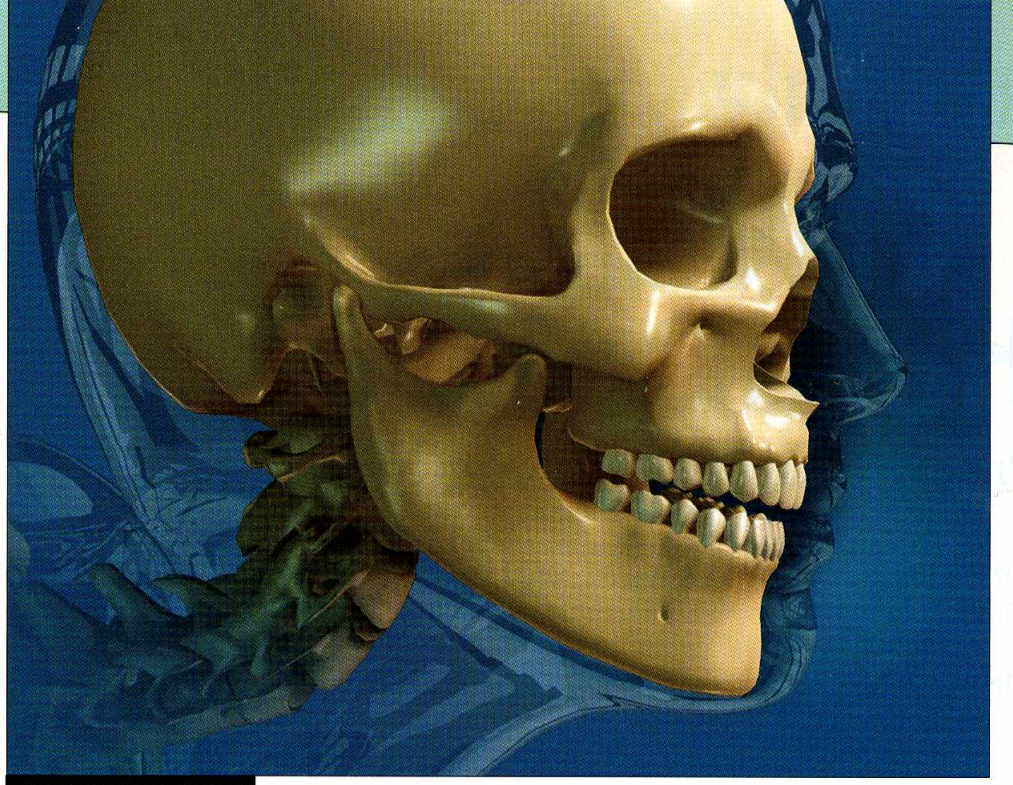
Dental Schools Don't Teach Occlusion

Without scientific evidence, it has not been proved definitively that treatment planning with any one philosophy is better than using the patient's own occlusion. Each approach has worked in many people, so we can't say that there's only one thing that works. Thus, dental school faculty question why a great deal of curriculum time should be devoted to teaching conflicting theories about occlusion.

Without consensus, dental schools have not addressed occlusion comprehensively. Most of our experts don't criticize schools of dentistry, however. "Dental school provides a beginning for what we do in dentistry, it's not the endpoint," says Dr. Kois. The lack of occlusion curriculum is justified when you start to realize the variability that humanity has, he says. It simply can't be covered in dental school.



JOINT-BASED



CENTRIC RELATION

"Four years is a short time to teach everything there is to know about dentistry," Dr. Sesemann agrees, "so choices have to be made as to what to include or not include in a curriculum. A student cannot master occlusal theory in dental school. It is a place to learn anatomical facts and how to do basic, single-tooth dentistry in a conformative occlusal scheme." One attains higher-level knowledge of the masticatory system and ways of providing complex dentistry only after graduation.

Individual Initiative and Self-Study Required

Unable to rely on dental school education in this case, dentists must pursue postgraduate education about occlusion on their own initiative, necessitating a substantial investment in both time and money. Therefore, before they even decide which postgraduate institution to attend, dentists must spend time researching the possibilities—itself a time-consuming prospect. "Understanding occlusion takes deliberate learning and years of experience," says Dr. Kois, and it is an arduous journey.

"Occlusion is probably our weakest area of training because of the profession's inability to come to a consensus on how to evaluate an occlusion and how to treat occlusal problems," says Dr. McKee. Unfortunately, most dentists are lacking in postgraduate education and stop intensive course work after finishing dental school, says Dr. Dickerson. He suggests that they should instead view graduation from dental school as a license to learn more about dentistry.

Why the Controversy?

"If there was only one approach that worked, we would say this is the way it should be done, and that nothing else works," says Dr. Spear. But with occlusion, there are multiple approaches that will work. You can use one approach with one patient and it works, and yet the same approach doesn't work when used on a different patient. "Everyone has their own philosophy or belief about how occlusion should be done, and can point to the fact that they've been successful—which is true. But at other times those same approaches may not be successful," he says.

It is important to acknowledge that whether one is a proponent of a centric relation, joint-based, or neuromuscular-based occlusal philosophy, those in the respective camps sincerely believe that there are reasons why one reference point is better than the other. Each can point to successful treatment of many patients. But the division into camps has sometimes been described as "almost religious," with "gurus and disciples."[4] There is also a paradigm effect, in which one filters all available data, valuing only data that support a growing belief while discounting or dismissing opposing opinions.

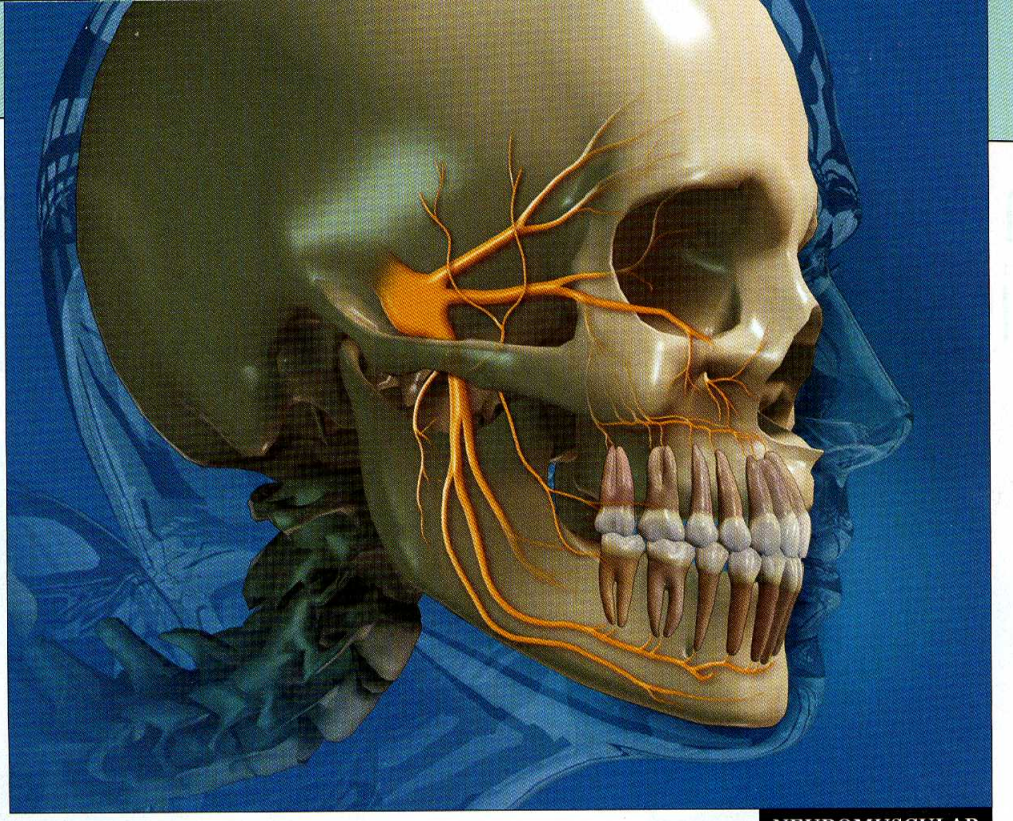
"The controversy can become quite emotional, taking on a life of its own as loyal followers defend hallowed ground," says Dr. Sesemann. "The TM joint versus muscles 'battle' is a factor that can be strongly differentiated for philosophical as well as commercial objectives," he cautions. "Problems arise when, in the process of emphasizing that difference, marketing rhetoric and heated debates can spin out of control, becoming disrespectful and hurtful."

Main Sources of Disagreement

At the heart of much of the controversy in occlusion is which reference position—the muscles or TMJ—one should use to build a healthy masticatory system. "If the teeth don't currently fit together, you can no longer use the teeth as your reference for occlusion. You then need to use two other systems to rebuild the occlusion: the joint as a reference position (ie, centric relation) or the muscles to orient the lower jaw as a reference point (ie, neuromuscular)," Dr. Kois explains.

According to Dr. McKee, the joint-based occlusion philosophy grew out of the realization that a significant number of patients have unrecognized structural damage to the TMJs. The ability to image the TMJ with computed tomography illuminated the true prevalence of joint damage, especially among women, who are more prone to ligament injuries. Further complicating matters, there are differing views within the centric relation philosophical camp as to where centric relation actually is, with many instructors differing in terms of techniques and final position of centric relation.

Differences also exist with regard to treating bruxism. Neuromuscular proponents believe that bruxism is related to the bite and can be stopped with changes to the occlusion. Most dentists in other occlusal camps believe bruxism is a central nervous system function related to a certain sleep stage, and that people are going to grind their teeth whether they



NEUROMUSCULAR

MORE THAN HALF OF THE TOTAL NEURAL INPUT TO OUR BRAIN COMES FROM THE TRIGEMINAL NERVE.

are balanced occlusally or not. "We can't necessarily stop patients from bruxing, but we can change the impact the muscles are having on the jaw joint and the teeth by changing the way the bite fits," Dr. Spear says.

Areas of Agreement

There are actually multiple areas of agreement among the different occlusal philosophies. As Dr. DuPont points out, most of the different occlusion schools of thought have more in common than not in common.

- There is consensus among all the experts interviewed that occlusion should be a routine part of every patient assessment and every procedure.
- The teeth should hit evenly and with equal intensity so that no one tooth is taking all the force.
- The anterior teeth should guide the posterior teeth when the patient takes their teeth in any movement or excursive pathway.
- All the teeth should fit within the confines of the muscle forces for the best stability.
- Eliminating interferences is important.
- Functional movements should allow for access to maximum intercuspation without interferences occurring in the posterior teeth or anterior teeth.
- The shapes and positioning of the anterior teeth influence healthy guidance patterns (though there is disagreement as to whether anterior teeth contact in functional movements).

Although there is general agreement that posterior teeth must have equal, simultaneous, bilateral contact in an unstrained joint position, what experts don't agree about is the way you arrive at the solution when a patient presents with less than ideal contacts.

Occlusion as an Obligation

Any time a significant amount of dentistry is being contemplated, it is paramount that practitioners know what they are proposing to change, why they are proposing the change, and how to go about doing it while exercising a responsible clinical acumen. "To not have occlusion as part of any initial diagnostic dialogue is a recipe for potential disaster," asserts Dr. Sesemann.

Dentists need to learn all they can about occlusion because they can't diagnose what they can't see—and they can't see what they don't know.

It's a moral issue as much as a legal one, says Dr. McKee. It's one of the things that should be included in the dialogue with every patient. "Every dentist needs to understand all aspects of occlusion in order to have a better understanding of what can happen if dentistry is done in an occlusionless vacuum," says Dr. Dickerson. Not having sufficient knowledge about occlusion to recognize the signs and symptoms of harmful occlusal forces leads to a failure to diagnose a patient's root problems and instead focuses treatment on only the signs and symptoms.

Making occlusion treatment more affordable is an obligation for Dr. Kois, and he is working to create entry points to make treatment available to more people. The focus of occlusion, he believes, should be on children. They are wearing down their teeth by the time they are teens, and the goal is to keep them from needing significant dentistry in their 50s and 60s. "Occlusion is the next frontier that is left virtually untapped by most of the profession because most dentists, including me, are so highly trained that we have priced ourselves out of what most people can afford," says Dr. Kois.

What's Changing?

As part of a trend toward an individualized approach to occlusion, the concept of an "ideal occlusion" is now questioned. A rigid, dogmatic approach to therapy that implies that one fixed, predefined concept should be applied to all patients, in all situations, holds much less sway. There is a greater appreciation that the concept of ideal is something like "infinity," in that it can be approached but never actually reached.[2]

In the past decade, there has been a shift toward a greater appreciation of the individuality of each patient as an important determinant of the occlusion method used. "The masticatory system must be viewed within the context of the overall physical and emotional health of the patient," notes Dr. Kois, who advocates moving away from treating symptoms toward understanding the causes for symptoms. Functional or parafunctional forces in one person may produce a tissue response, sign, or symptom that is different than that produced in another individual. Deciding on what you're trying to do should be based on the diagnosis of what is wrong, not a dogmatic philosophy.

"Some schools of occlusion are increasingly comfortable with not choosing a side, in talking about the successes and/or failures of different approaches, and illustrating places where those different approaches are possibly the best way to go," says Dr. Sesemann. Things have been moving in that direction for 10 to 15 years. Prior to that, the camps were a lot more divided. "You either believed their way or you were doing something detriwwmental to the public," he notes.

"It's a very different way of looking at occlusion now than it was when I trained 35 or 40 years ago," says Dr. Spear. His approach is "diagnostically driven," and "anti-one approach," because he believes any one philosophy is too narrow. Each occlusal philosophy wants to present itself as *the* answer, *the* way to do it, he says, but when you treat a human being, there isn't just one answer. You have to examine the patient's joints, muscles, and teeth looking for wear, fractures, and other problems, and you can decide what your options are to design the occlusion based on those findings.

Change will come quickly as Baby Boomer dentists retire and are replaced by a new generation of dentists who grew up with computers and are trained in 3D imaging in dental school, Dr. McKee predicts. They will be more comfortable with the technology and better metrics that are being developed in occlusion treatments.

There is an evolution in continuing education as well. In the past, there simply wasn't the array of resources available today, particularly in terms of user-friendly online and printed educational information on occlusion that can enable more dentists to continue their education. There are more opportunities for face-to-face meetings, which used to be rare. In years past, there was a controlled amount of information, and a few printed journals. With so much more information available, there is a good chance that the future of occlusion philosophy will move toward more cohesion.

Choosing Education in Occlusion

The best way to explore post-graduate education in occlusion is to start by getting exposed to all the concepts involved so that you can decide why you would develop one occlusion over another in a particular case. Become familiar with the various options and choices. It is important to seek out feedback from colleagues about their experiences. Try to learn about the different occlusal philosophies through the various programs offered online, on DVDs, and through videos, and familiarize yourself with the various institutes and schools by attending their meetings or taking online courses. Eventually you need to get comfortable through hands-on workshops and repetition.

Table 2 lists the expert sources mentioned in this article and provides a good starting point to help you move into the next phase of your dental education in occlusion. Renew your license to learn and you can reap the rewards of better treatment planning and a higher level of care for patients.

TABLE 2

Sources of Continuing Education for Dentists

The following programs and centers were mentioned in this article:

THE DAWSON ACADEMY
St, Petersburg, Florida
www.thedawsonacademy.com

THE KOIS CENTER
Seattle, Washington
http://koiscenter.com

LAS VEGAS INSTITUTE FOR ADVANCED DENTAL STUDIES (LVI)
Las Vegas, Nevada
www.lviglobal.com

PANKEY INSTITUTE
Key Biscayne, Florida
www.pankey.org

PIPER EDUCATION AND RESEARCH CENTER
St. Petersburg, Florida
www.pipererc.com

SPEAR EDUCATION
Scottsdale, Arizona
www.speareducation.com

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