

Are Occlusion and Comprehensive Dentistry *Really that Important?*



A primary tenet of comprehensive dentistry is that all of the components of the masticatory system...are intimately related and dependent upon one another for ideal function.



Learning Objectives:



After reading this article, the participant should be able to:

1. Develop a better understanding of centric relation, how to use it, and ways to find and record it.
2. Recognize when an alteration in the existing occlusal scheme might be beneficial prior to case treatment.
3. Understand the value of earbow transfers and properly mounted models for case diagnosis.

A Seven-Year Follow-Up: Addressing Structure First

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Abstract

Patient demand for cosmetic dentistry has never been greater. This has led many dentists to invest considerable time, effort, and money in mastering various cosmetic procedures and techniques. While this is commendable, it should be recognized that it is one thing to be able to make beautiful teeth, and an entirely different thing to make beautiful teeth that actually last and function in harmony with the rest of the masticatory system. An acceptable cosmetic result, without regard for function and/or parafunction, will often result in premature case failure. What the truly successful clinician of today requires is a logical and systematic methodology in approaching cosmetic/restorative cases that will lead to a reasonably predictable and durable end result. The following case presentation describes how a comprehensive approach to dentistry, one that integrates both function and esthetics, can be used to successfully diagnose, treatment plan, and predictably restore a cosmetic/restorative case. Seven-year follow-up images are also presented.

Key Words: Occlusion, comprehensive dentistry, centric relation, facebow transfers, congenitally missing laterals

Introduction

A true understanding of occlusion and comprehensive dentistry is crucial in order to become the best dentist possible. The fact is, the longevity and predictability of all the beautiful dentistry that clinicians create, and the overall comfort and functioning of their patients, is predicated on just how well they understand and apply the principles of occlusion and comprehensive dentistry. A primary tenet of comprehensive dentistry is that all of the components of the masticatory system (teeth, soft tissues, skeletal structures, muscles, and joints) are intimately related and dependent upon one another for ideal function.^{1,2} This interrelationship is mediated by the central nervous system via the exquisite proprioceptive nerve network that permeates the entire gnathic system.

Comprehensive Dentistry

Comprehensive dentistry is really about seeing, understanding, and treating the “big picture.” This is a far different approach than the “see the hole, fill the hole” mentality often employed in restorative dentistry. Addressing esthetic concerns is also an integral component of comprehensive dentistry. Creating “ideal” functional and masticatory relationships and harmony without addressing esthetics will almost always lead to patient disappointment no matter how well the case functions from an occlusal standpoint. Conversely, an “ideal” esthetic result without regard for function and/or parafunction often leads to case failure and/or masticatory disharmony. The dentist who wants to practice truly excellent dentistry must be able to think comprehensively and address both function and esthetics.³⁻⁵

Occlusion

An understanding of occlusion is essential to practicing comprehensive dentistry. There are at least five occlusal philosophies in use today (classic gnathology, bioesthetics, Dawson/Pankey, neuromuscular, and maximum intercuspation position [MIP]). While an in-depth discussion of each of these philosophies is well beyond the scope of this article, it is probably safe to say the vast majority of dentists use MIP (habitual closure) as a starting and ending point when developing an occlusal scheme. The reason for this is probably because it requires the least thought, time, knowledge, and effort. The dentist simply works with the occlusal relationship as it exists. The problem is that in many



Figure 1: Preoperative full smile.



Figure 2: Preoperative retracted view with teeth apart. Note the lingual thinning of the upper anterior teeth, chipping and wear of the lower anterior teeth, and abfraction-type lesions on several teeth.



Figure 3: The removable partial denture (“flipper”) that the patient was wearing on her initial visit.

cases the patient's existing MIP and occlusal scheme is far from ideal. In fact, it may be a destructive relationship, causing a problem, or problems, somewhere in the masticatory system. These problems can manifest as muscular pain, joint problems, wear and/or chipping of teeth, tooth mobility, tooth sensitivity, an uncomfortable bite, and a variety of other symptoms. By using the existing bite relationship in such a situation, dentists are in fact placing restorations into an occlusal scheme that may not be working particularly well for that patient. In such cases it would seem logical to try and improve the occlusal/masticatory relationships prior to, or in conjunction with, performing the restorative/prosthetic dentistry.⁶ The questions to ask are, when does the patient's existing occlusal scheme need to be altered prior to performing restorative/prosthetic procedures and when is it acceptable to work with the occlusal scheme as it exists? The following case presentation, in which both functional and esthetic issues are addressed, demonstrates a comprehensive approach to restorative/cosmetic dentistry. In this particular case, for reasons that will become apparent, the existing occlusal scheme was altered prior to performing the prosthetic dentistry. A detailed rationale and methodology is described. The case demonstrates just how the science of occlusion and comprehensive dentistry can actually be applied to clinical dentistry.

Case Presentation

The patient, a 37-year-old female in good health, was referred to our office for a consultation regarding the replacement of congenitally missing maxillary lateral incisors and improving the appearance of her teeth and smile (Figs 1 & 2). At the age of 20 she underwent 15 months of orthodontic treatment to reposition the upper anterior teeth in order to create space between the central incisors and canines. She had had three different Maryland-type winged bridges since that time (including one all-ceramic resin bonded bridge). All of these failed for various reasons and the patient stated she was never happy with how any of them looked and that they would fall out frequently. For the last six months she had been wearing a removable "flipper"-type partial denture that she said she hated (Fig 3). She stated that she had always been self-conscious about her teeth and smile, and often avoided smiling in photographs. She had recently consulted with a number of other dentists and had explored restorative options including implants, new resin-bonded bridges, and fixed bridgework. Both an oral surgeon and periodontist had determined that insufficient space existed for implants (Figs 4 & 5). The patient also mentioned

“ It is up to clinicians, through comprehensive diagnostic examination and evaluation, to develop a treatment plan that fulfills not just the esthetic but also the functional requirements of a case. ”



Figure 4: Occlusal view of the upper anterior teeth showing lack of sufficient interproximal space for implants.



Figure 5: Radiographic appearance of the anterior teeth showing insufficient space for dental implants.



Figures 6 & 7: The earbow is used to record the relationship of the maxilla relative to the TMJs. The data are then transferred to an articulator. The correct hinge axis starting position (or close approximation) is essential when taking an open bite record.

that her bite was not comfortable (“it feels off”) and that it often felt like she had “two bites.” She was not aware of any grinding or clenching habits. Her periodontal status was excellent and her medical history was unremarkable. When she was asked specifically what she would like as far as her teeth and smile were concerned, her reply was: “a whiter/brighter smile, something that looks really nice and I feel good about, something that will last, nothing I can put in and take out, and I would like my bite to feel comfortable because it has never felt right.”

Treatment Planning

Discussion

The fact is many dental patients have never been treated in a comprehensive fashion and the concept is new to them. It is often helpful to show patients another case that has already been worked up and treated comprehensively to help them better understand what is involved and the advantages of such an approach. A typical comprehensive exam requires 60 to 90 minutes and includes a visual examination of the dentition and soft tissues, full set of radiographs, full maxillary and mandibular alginate impressions, diagnostic digital photographs, an earbow transfer, and centric relation (CR) and/or MIP bite record. In addition to this, a TMJ,

range of motion, and muscle screening examination is performed. Stable and comfortable joints are essential prior to definitive treatment. Input from other dental specialists and/or other diagnostic imaging (in addition to conventional dental x-rays) may also be required. The information from the comprehensive exam is used to formulate a concise written narrative describing, among other things, just what it is the patient is looking to do, clinical findings, one or more treatment options, advantages and disadvantages of each option, time frames involved, and anticipated fees for treatment. Diagnostic photographs are an integral part of any comprehensive exam and it is imperative that dentists be adept with digital photography. It is also essential that dentists understand how to take an earbow transfer and why it is so important. The earbow is used to record the relationship of the patient’s maxillary arch relative to the temporomandibular joints and then transfer this relationship to an articulator (Figs 6 & 7). An earbow transfer is absolutely essential whenever an open bite record is taken as is typically the case when taking a CR bite record. The correct axis of condylar rotation (actually a close approximation) is recorded by the earbow and then an upper cast of the patient’s maxillary arch is mounted relative to this hinge axis position. If the correct hinge axis is not recorded

via an earbow or hinge axis recording when taking an open bite record, then the casts will not meet properly when the models are closed together. In addition, the starting hinge axis position will have an effect on excursive pathways. An incorrect hinge axis position during fabrication of the definitive restorations will usually result in considerably more time spent adjusting the case during placement. Even if the dentist chooses to take a closed MIP bite record, it is advantageous to take an earbow transfer and upper cast mounting will enable the dentist and technician to visualize any cant of the maxillary teeth as they relate to the facial midline and horizon. In other words, the earbow transfer relates the “esthetic plane” (line from upper canine to canine) to the articulator just as it appears in the patient’s mouth with the head held straight and erect (Figs 8-10). In the author’s opinion, a properly taken earbow transfer is quicker and more accurate than “stickbite”-type registrations for evaluating horizontal and vertical planes (although stickbite, along with facial photographs, can be a useful adjunct). The use of a level is useful in helping to orient the earbow to the horizon. This is achieved by having the patient stand, or sit upright in a chair, and then orienting the head so it

appears level, straight, and erect, relative to the horizon (the head is not tipped or canted relative to the floor). The anterior component of the earbow is then positioned in the horizontal plane until the bubble in the level is centered (Fig 11). Although many dentists use the interpupillary line to orient the earbow, this is often incorrect because it is not uncommon to have one eye significantly higher or lower than the other (Fig 11). Anterior restorations created parallel to the interpupillary line in such a situation will typically appear canted. One of the treatment goals is to create an esthetic plane of occlusion that is parallel to the horizon, with the head straight and erect, regardless of any facial discrepancies.⁷

A TMJ and muscle-screening exam must be part of any comprehensive exam. The simple fact is that any change in condylar position and/or morphology will affect the way the teeth come together. Conversely, any change in tooth form or position has the potential to affect the position of one, or both, of the condyles in their respective sockets. It simply makes sense that we ascertain the condition of the joints and position of the condyles in the patient's existing MIP position, prior to definitive treatment. The author uses a simple, concise temporomandibular joint (TMJ) and muscle-screening exam form as a guide during this aspect of the comprehensive exam. It is important to establish baseline parameters in terms of joint and muscle health prior to treatment. If problems are suspected then other diagnostic information, such as joint imaging, may be required. Stable and comfortable joints are vital to overall case comfort, stability, and predictability.

Red Flags

In this particular case, several "red flags" were evident regarding the stability and comfort of the patient's existing occlusal scheme. The patient stated that she was "not comfortable with her teeth touching" and her bite "felt off." She had also mentioned that it felt like she had "two bites." During the screening exam, consistent reciprocal clicking (clicking on opening and closing) of the left TMJ was noted. The patient also had pain in this joint with direct palpation. Lingual thinning of the upper anterior teeth, and chipping and wear of the lower anterior teeth were also evident (Fig 2). Both joints could be comfortably loaded with light and firm pressure via bimanual manipulation (Figs 12 & 13). A severe "hit and slide" from centric relation (CR) to MIP was noted. "Hit and slide" is the terminology used to describe the slide seen as patients squeeze their teeth together from the first point of tooth contact with the joints in CR to a MIP intercuspal position (Figs 14 & 15). Centric relation



Figure 8: Wax try in of a denture with a canted esthetic plane. An earbow transfer was taken with the denture in place and used to mount the denture on a semi-adjustable articulator (also see Figure 9).

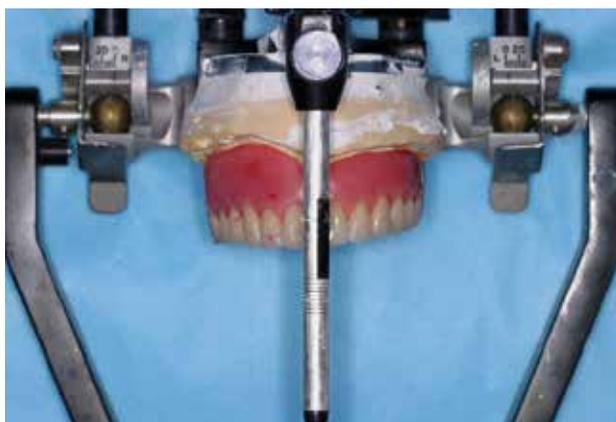


Figure 9: A properly taken earbow and upper cast mounting will enable the technician to visualize the cant as it actually appears in the patient's mouth, with the head straight and erect, allowing for easy correction (also see Figure 10).



Figure 10: Denture with the corrected esthetic plane after resetting the teeth parallel to the horizon on the articulator (also see Figure 9).

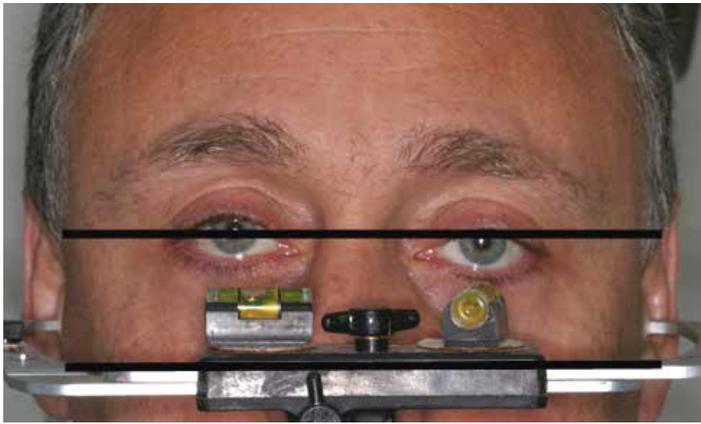


Figure 11: The author often uses a level to help align the earbow parallel to the horizon. In this example, it is easy to see that if the interpupillary line were used to determine the esthetic plane, the final restorations would be canted relative to the horizon once they were placed in the patient's mouth. This is because one eye is significantly higher than the other.



Figure 12: Frontal view of proper finger position for bimanual manipulation. Bimanual manipulation uses a gentle hinging movement of the mandible to guide and fully seat the condyles up in the glenoid fossa.

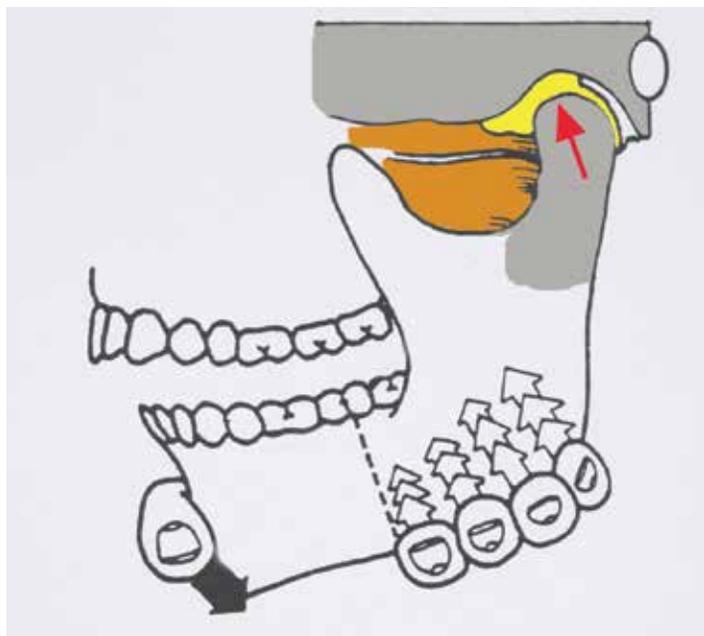


Figure 13: Sagittal diagrammatic illustration of bimanual manipulation demonstrating proper finger positioning and how the mandible is rotated to fully seat the condyles in their respective sockets. (Image courtesy of Dr. Peter Dawson.)

is a joint-based position where the condyles (medial poles) are fully seated in their most superior position in the glenoid fossa and the disks are in their proper position and orientation on the condylar heads. What clinicians need to understand is that CR is a repeatable, joint-based axial position found completely independently of the teeth.⁸⁻¹¹ The teeth are in fact totally superfluous to the location of CR.

Centric Relation

Because there was clear evidence of occlusal disharmony in this case, the author felt a CR bite record and mounting was essential to properly diagnose the existing occlusal relationships. In the author's experience, CR can be determined in the vast majority of patients without prolonged splint therapy (as is advocated by some). CR can be determined by a number of methods, including bimanual manipulation, leaf gauge, central bearing point and Gothic arch tracing, and various types of anterior deprogrammers such as a Lucia jig and Kois deprogrammer.¹²⁻¹⁶ Although the author has had experience with all of these, the technique he most often uses is bimanual manipulation (BMM) in conjunction with a simple anterior deprogrammer (Pankey deprogrammer). The deprogrammer is painted with a polyvinyl siloxane (PVS) adhesive and filled with a very firm and quick-setting PVS (Quick Bite, Clinician's Choice; New Milford, CT). It is then placed over the upper anterior teeth and the PVS is allowed to set. The surface of the deprogrammer should be kept parallel to the occlusal plane. The patient is then placed in a horizontal position with the deprogrammer in place for approximately 10 minutes. The idea is to keep the teeth apart for a period of time to assist in muscle relaxation and deprogramming. Some

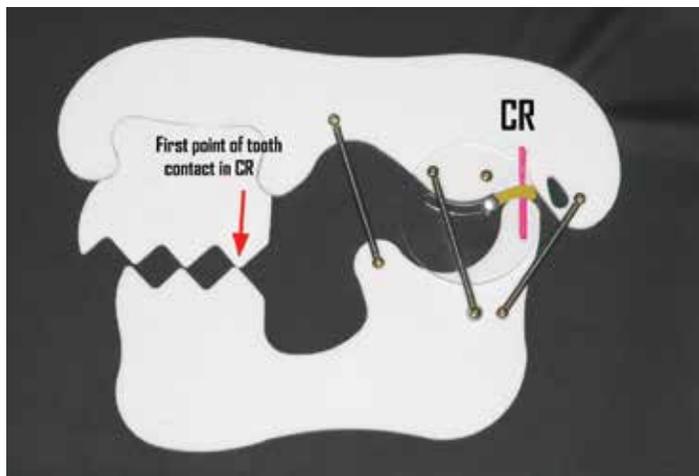


Figure 14: TMJ illustrator demonstrating the first point of tooth contact (arrow) with the condyles in CR.

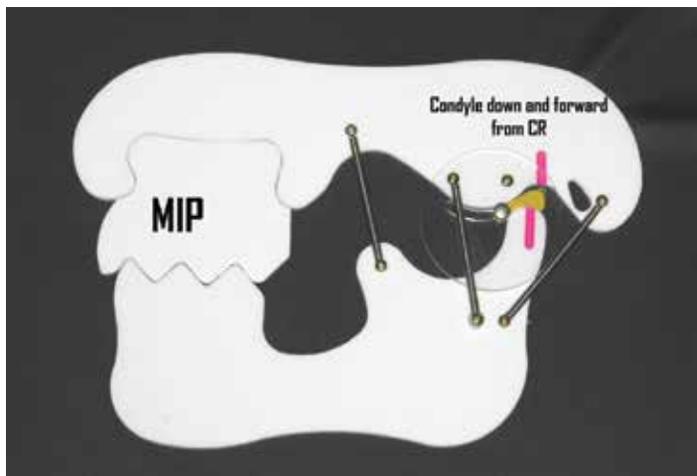


Figure 15: As the “teeth” close/slide together into MIP, the condyles are no longer in CR but are down and forward from that position. This movement, from the first point of tooth contact with the condyles in CR (see Figure 14) to an MIP tooth-based position, is called a “hit and slide” from CR to MIP.

patients can be deprogrammed very quickly while others require more time (a small percentage may require splint therapy). Muscle relaxation, especially of the lateral pterygoids, is one of the keys to locating a correct CR position.¹⁷ To paraphrase Dr. Frank Spear: “CR is not a position you have to put people in, it is a position the condyles go to when the lateral pterygoids relax.” After deprogramming, BMM is used to gently hinge the mandible, helping to guide and seat the medial poles of the condyles up into CR as described by Dawson.^{1,2} Once the dentist feels that CR has been found and verified,¹ the same hinging motion is used to guide the lower anterior teeth through a thin layer of unpolymerized composite, that is placed on the surface of the Pankey deprogrammer (Fig 16). As the incisal edges of the lower anterior teeth penetrate the soft composite, they contact the hard surface of the deprogrammer. At this point the composite is light-polymerized, creating a very precise incisal index of the lower anterior teeth on the surface of the deprogrammer (Fig 17). It is important to roughen the smooth surface of the deprogrammer and brush on a thin layer of unfilled resin prior to placing the layer of composite (to ensure the composite sticks to the deprogrammer). If the CR position is correct, then each and every time the mandible is hinged using BMM the lower incisal edges will fit precisely into the incisal index. In fact, once the patient is deprogrammed no external manipulation is generally necessary as the patient, on command, will consistently close into the index without any external guidance. If everything was done correctly, the condyles will be in CR when the patient closes into the index. All that remains to be done is to inject a very stiff and firm-setting PVS (Futar D Occlusion, Kettenbach US; Huntington Beach, CA)



Figure 16: View of a Pankey deprogrammer that has been filled with PVS and seated over the upper anterior teeth. The surface of the deprogrammer has been roughened and coated with a Bis-GMA resin that facilitates adhesion to a subsequently placed thin layer of composite.



Figure 17: Bimanual manipulation is used to hinge the mandible in CR until the lower incisal edges penetrate the soft composite and contact the hard surface of the deprogrammer. The composite is then light-polymerized, resulting in a very precise incisal index. A very firm-setting PVS is injected between the separated posterior teeth while the patient is closed into the index to take the CR bite record (Delar Wax can also be used).

between the separated posterior teeth while the patient is closed into the index. The resulting bite record and incisal index are then used to mount the case in CR on a semi-adjustable articulator (Figs 18 & 19). There are several acceptable variations to this technique (e.g., the use of Delar Wax for the bite record as opposed to Futar D) but the fundamental principle is the same, and that is the use of BMM to create an anterior incisal index on a deprogrammer with the condyles in CR. Having taught this procedure to hundreds of dentists, the author finds that most will pick up the technique relatively quickly. For those not comfortable with BMM (and some are not) then the use of a leaf gauge, Lucia jig, or Kois deprogrammer can be viable alternatives. However, a certain degree of “tactile” information is lost with these alternative techniques

into an MIP position. Basically, the same thing is occurring in the patient’s mouth. In order for her to bring her teeth together, one—or both—of the condyles must translate out of CR and move down the eminence to some degree. It should be pointed out that this is not always a clinical problem and that it might be acceptable to place restorations into an occlusal scheme such as this. Specifically, if there are no signs or symptoms of occlusal disharmony, and the patient is comfortable and has no difficulty chewing, then a change in the existing occlusal scheme may be unwarranted. Even a seriously flawed occlusion may be working quite well for a patient, and dentists need to be very cautious about changing an occlusion that is already working. Some patients have an extraordinary adaptive capacity and some just do not bring their teeth

compared to a more hands-on approach such as BMM.

Once the case was mounted in CR (using the open bite record described) the only point of tooth contact when the models were closed together was the mesiolingual cusp of #16 (Figs 20-22). This was the same first (and only) point of contact seen in the patient’s mouth when BMM was used to hinge the mandible into CR (Fig 23). The fact that what we see in the mouth is duplicated precisely on the articulator confirms the accuracy of the CR mounting. The patient’s hit and slide from CR to MIP can be easily visualized by unlocking the articulator hinges and sliding the models together

together very often. In regards to occlusion, it is not until opposing teeth touch that things begin to happen. In the author’s opinion, it is a mistake to alter an existing occlusal scheme that is already working solely to satisfy the “ideal” of any particular occlusal philosophy. Having said that, many patients have an occlusal scheme that is not working particularly well for them and dentists need to consider a change prior to placing definitive restorations. The key is to know when a change is warranted and when it is not.¹⁸

The clinical findings and history in this case clearly indicated a problem with the existing occlusal scheme, so the decision was made to modify the occlusion prior to doing the clinical dentistry. One of the goals in a CR-based occlusion is the harmonization of MIP with CR. In other words, when the patient closes into MIP the condyles are also in CR. In this case, the only point of tooth contact, with the condyles in CR, was the ML cusp of #16. This tooth was essentially a nonfunctional third molar that also had mesial caries. It was decided to “extract” this tooth on the upper model to ascertain what effect this would have on the occlusion. The tooth was removed with a heatless stone and the models closed together with the articulator hinges still locked in a CR position (Fig 24). Just removing this one tooth eliminated almost all the hit and slide from CR to MIP and bilateral posterior contacts were now evident (Figs 25 & 26). Anterior coupling (anterior tooth contact) was subsequently achieved by minor equilibration of the models (Fig 27). The occlusal scheme created on the models resulted in a new MIP position that was now coincident with CR (Fig 28). By performing the occlusal correction on the models first, it was determined that the same process could easily be repeated in the patient’s mouth without excessive removal of tooth structure.

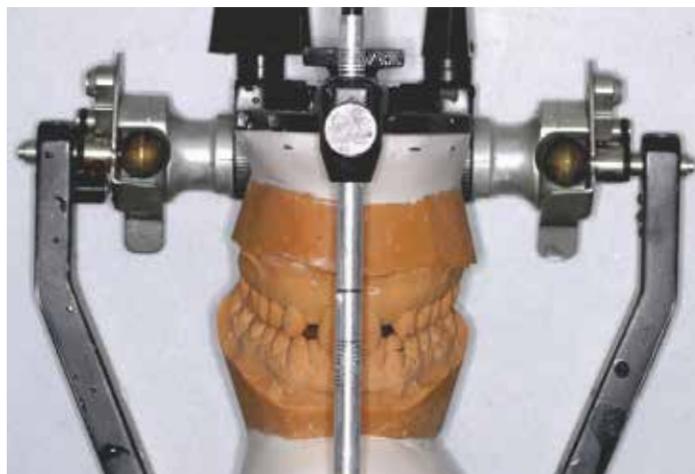
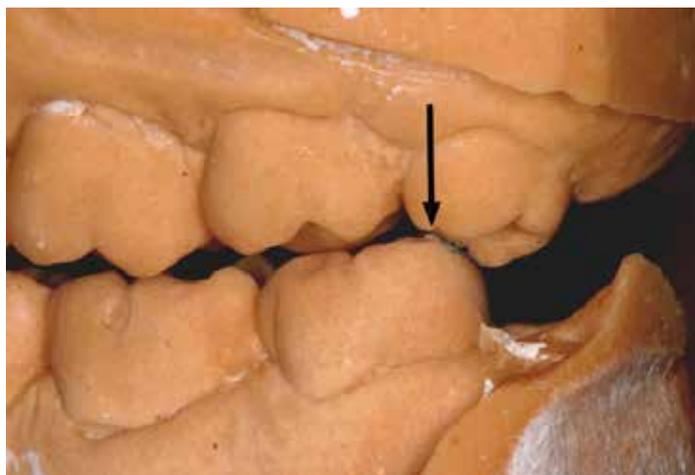
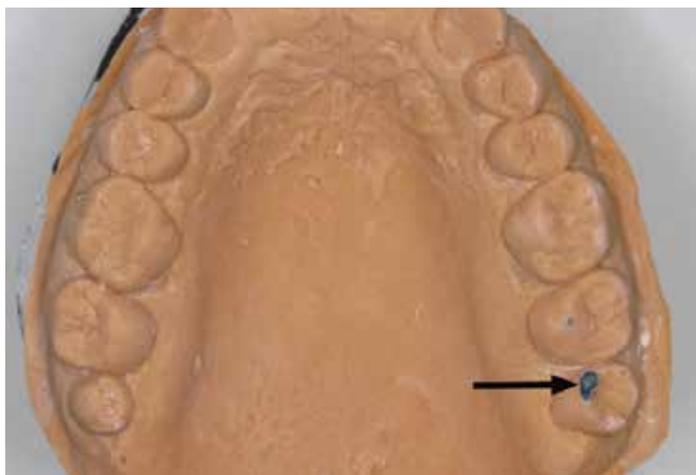


Figure 18: After the upper cast is mounted with the earbow transfer, the lower model is mounted to the upper cast using the CR bite record and incisal index.

Figure 19: Properly trimmed and polished CR mounted models on a semi-adjustable articulator.



Figures 20 & 21: When the models are closed together with the hinges locked in CR, the only point of tooth contact is the mesio-lingual cusp of #16 (compare with Figure 23).



Figure 22: In CR, all the teeth are far out of occlusion when the articulator is closed down with the exception of #16.

Figure 23: The fact that the same (and only) point of tooth contact we see in the mouth using bimanual manipulation to seat the condyles in CR is exactly the same as what we see on the articulator confirms the accuracy of the mounting.

// Having taught this procedure to hundreds of dentists, the author finds that most will pick up the technique relatively quickly. //



Figure 24: Tooth #16 is “extracted” on the model with a heatless stone.



Figures 25 & 26: Removing #16 eliminated almost all of the “hit and slide” from CR to MIP, and bilateral posterior contacts are now evident from the premolars back.



Figure 27: Anterior coupling (anterior tooth contact) was achieved by minor equilibration of the models after #16 was removed.

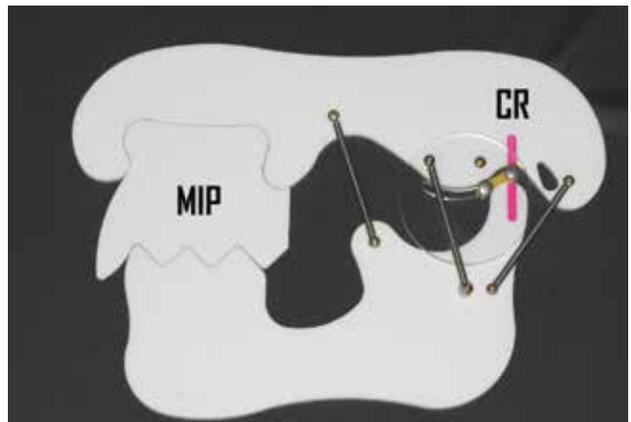


Figure 28: TMJ illustrator demonstrates the occlusal scheme created on the models that resulted in a new MIP position that is now coincident with CR.



Figure 29: Diagnostic wax-up of ##4-13. The diagnostic wax-up should be viewed as our “best guess” as to what the case should look like in its final form. It must be tested in provisionals. A matrix for provisionals, facial reduction guide, and incisal reduction guide are all fabricated from the diagnostic wax-up.



Figure 30: Exactly as was done on the models, #16 was extracted in the patient’s mouth, and the teeth equilibrated to CR. The patient’s “hit and slide” from CR to MIP was completely eliminated.

Other Factors

In addition to the aforementioned occlusal issues, a number of other factors were considered in developing a treatment plan for this patient. She was not a candidate for dental implants and was not interested in orthodontic re-treatment. She was not willing to accept a removable appliance of any type and she had had negative experiences with three different fixed Maryland-type bridge replacements. She had very high esthetic expectations. Space management was also an issue because the interproximal distance between the central incisors and canines was inadequate for replacement with laterals of appropriate width.

Treatment Plan

After considering all of the aforementioned factors and carefully evaluating the information obtained from the comprehensive exam, the following treatment plan was presented to the patient:

1. Diagnostic wax-up of ##4-13 on CR-equilibrated models with #16 removed. The anticipated treatment was porcelain veneers on #4, #5, #12, and #13 along with two three-unit Lava (3M ESPE; St. Paul, MN) bridges (##6-8 and ##9-11) with pontics at #7 and #10.
2. At the first appointment, #16 would be extracted and the teeth subsequently equilibrated with the condyles in CR to create a new MIP position that was coincident with CR (just as was done on the models). Deliver lower whitening tray for whitening of the lower anterior teeth (Nite White, Discus Dental; Culver City, CA).
3. The preparation appointment would consist of adjusting and evening out the lower incisal edges followed by the preparation of #6, #8, #9, and #11 for two separate Lava bridges with pontics at #7 and #10. Teeth #4, #5, #12, and #13 would be prepared for porcelain veneers. Final impressions would be taken along with a bite record and photographs of the prepared teeth. Provisionals would then be fabricated using the matrix made on the diagnostic wax-up.
4. Two days after preparation and provisionalization the patient would be seen and the provisionals evaluated for esthetics, phonetics, occlusion, and function (adjustments made as required). Once the provisionals were deemed acceptable, a series of photographs would be taken along with an alginate impression so a solid model of the provisionals could be fabricated. The model, along with the photographs, would help guide the ceramist in the fabrication of the definitive restorations.



Figures 31 & 32: The incisal edges of the lower anterior teeth were altered slightly to create a more esthetic and even incisal profile. Great care should be taken whenever lower incisal edges are altered. It is very important to preserve the proper incisal inclination and maintain a sharp buccal-incisal line angle.

5. During the placement appointment the case would be tried in and the final restorations evaluated. Once the case was approved by both the patient and the dentist, the restorations would be bonded and/or cemented into place. After the case was placed, impressions would be taken for the fabrication of a nightguard (which would also serve as a retainer).
6. Adjustments as required and insert nightguard/retainer.

Treatment

The patient accepted the treatment plan as presented and was anxious to begin. The equilibrated models were sent to the laboratory and a diagnostic wax-up was returned along with matrixes for provisional restorations and reduction guides (Fig 29). The diagnostic wax-up should be viewed as our "best guess" as to what the case should look like in its final form. The only way to ascertain that this "guess" is correct is to try the case in provisionals that duplicate the wax-up and see what it actually looks like in the patient's mouth.

The treatment began by essentially doing exactly what was done on the mounted models. As on the models, #16 was extracted and the teeth equilibrated to CR (Fig 30). The patient's hit and slide from CR to MIP was complete-

ly eliminated. The following week, the patient was reevaluated and she reported that she was very comfortable with her new bite. In her own words: "This is the first time since I can remember that my bite has felt comfortable and I know how my teeth should fit together."

Once the occlusion had been addressed, the teeth were prepared as treatment planned. First, the incisal edges of the lower anterior teeth were modified to create a more esthetic profile (Figs 31 & 32). Great care should be taken whenever lower incisal edges are altered. It is very important to preserve the proper incisal inclination and maintain a sharp buccal-incisal line angle. In this case, there was a degree of latitude in reshaping the lower incisal edges because the lingual contours of the upper anterior Lava bridges could be designed as required to ensure proper occlusion with the altered lower incisal edges. After the lower incisal edges were reshaped, the upper canines and centrals were prepared for Lava bridges and the premolars for porcelain veneers. Final impressions were taken with a polyether impression material (Impregum Penta Soft Quick Step, 3M ESPE). A closed bite record was also taken. (It should be noted that the closed MIP bite record was now also a CR bite record because the patient had been equilibrated to an MIP position that was now coincident

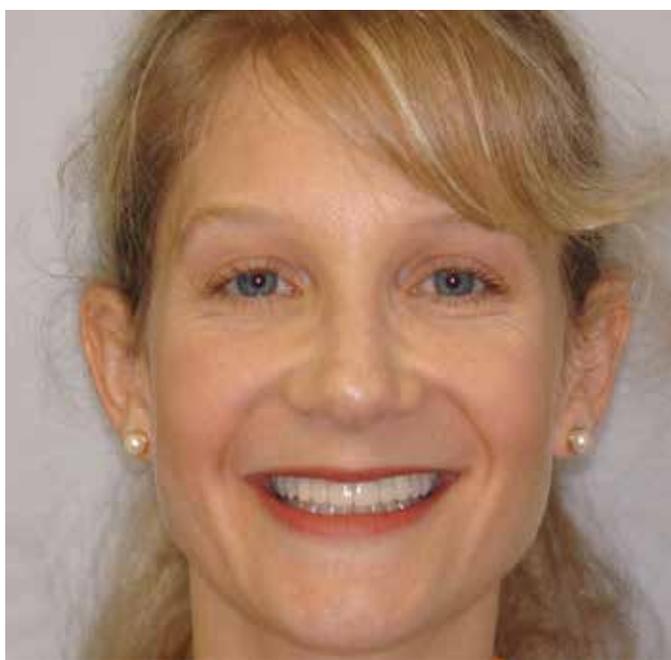
with CR.) Provisional restorations were fabricated using the matrix fabricated from the diagnostic wax-up in conjunction with Luxatemp Fluorescence B-1 shade (Zenith/DMG; Englewood, NJ). The matrix was filled with the Luxatemp and seated over the prepared teeth (Fig 33).

Once the Luxatemp was set, the provisionals were removed so that they could be smoothed and polished outside of the mouth. The occlusion was adjusted and the provisionals were placed by spot-bonding in the veneers and cementing the anterior bridge segment with TempBond (Kerr; Orange, CA).

The patient returned two days after the preparation appointment so that the provisionals could be evaluated for comfort, esthetics, phonetics, and function (Figs 34 & 35). The patient stated she was "very happy" with the look of the provisionals but wanted her final restorations to be whiter. Once the case had been worked out in provisionals, an incisal index was fabricated to precisely record the incisal edge position of the central incisors. In addition to this, various digital photographs were taken along with an alginate of the provisional restorations. A solid model of the alginate impression was fabricated and sent to the laboratory along with the photographs and incisal index.



Figure 33: Matrix fabricated from diagnostic wax-up being filled with Luxatemp.



Figures 34 & 35: The patient was seen two days after the preparation appointment so that the provisionals could be evaluated for comfort, esthetics, phonetics, and function.

With this information, a good ceramist can duplicate everything that was right with the provisionals in the final restorations and/or make modifications as required. Using the provisionals as a guide^{19,20} is a far more predictable approach than simply having finished restorations returned and “hoping” the case looks good, feels good, and functions well.

The master models and finished restorations were inspected after they were received from the laboratory (Figs 36 & 37). The restorations were subsequently evaluated in the patient’s mouth to ensure proper fit, occlusion, and esthetics. Once approved by the patient, the restorations were placed by first bonding in the porcelain veneers (Fig 38), followed by cementation of the anterior Lava bridges (Fig 39). The veneers were bonded in with the total-etch adhesive One-Step Plus (Bisco; Schaumburg, IL) using a wet bonding protocol.²¹⁻²⁴ Once the veneers had been placed, the intaglio surfaces of the Lava bridges were sandblasted with 50- μ aluminum oxide at 30 psi and cemented with a resin-modified glass ionomer cement (RelyX Plus, 3M ESPE).^{25,26} After all the restorations were placed, final finishing and polishing was performed under high magnification and the occlusion checked in MIP and all excursive movements. The patient was given oral and written postoperative instructions.

The patient returned one week after the case was placed for final adjustments, photographs, and the insertion of a flat-plane hard/soft acrylic upper nightguard. She was delighted with the final results (Figs 39-41).

Follow-Up

This case was placed in August of 2005 and has been followed carefully since that time. The patient has been seen every six months for prophylaxis. She has excellent homecare and wears her nightguard every night. More than seven years after this case was placed there has been no structural breakdown of the porcelain, no problems with veneers debonding, and the patient states her bite and joints are “very comfortable” (Figs 42-44).



Figure 36: Model showing preparations for the Lava bridges on ##6-8 and ##9-11.



Figure 37: Definitive restorations (veneers for all four premolars and two Lava bridges).



Figure 38: The porcelain veneers on the premolars were placed first using a total-etch adhesive system protocol.



Figure 39: The Lava bridges were cemented with a resin-modified glass ionomer cement.



Figures 40 & 41: Finished case.



Figures 42-44: Restorations nearly seven years after placement. At this point the patient has had no problems, is “delighted” with her new smile, and has a comfortable and stable bite relationship.

Discussion

It is interesting to speculate on the cause of the damage to the patient’s anterior teeth at the time of her initial presentation (chipping, wear, lingual thinning of the uppers). It is also interesting to note that the posterior teeth had little to no wear. A chipping and wear pattern of this nature might be consistent with a protrusive bruxing habit where the front teeth touch but not the back teeth, anterior tooth interference with the patient’s envelope of function, a habit of some type, or a combination of these. The patient was not aware of any bruxing or clenching habits. She also could think of no habits (fingernail/cuticle biting, holding objects with her teeth, etc.) that might have contributed. It is unlikely that there were problems associated with the patient’s envelope of function. Envelope of function issues typically occur when there is a lack of horizontal freedom for the lower incisal edges during function (not enough “room to roam”). That is, the lower incisal edges are interacting in a destructive fashion with the upper anterior teeth (usually the lingual inclines and/or incisal edges) during normal chewing and functioning. In the author’s experience envelope of function problems are more often associated with deep overbite and/or constricted envelope dentitions (neither of which the patient had).

The severe “hit and slides” from CR to MIP the patient had prior to treatment is what the author believes caused the damage to the front teeth in this case. In other words, as the patient closed, the elevator muscles tended to pull the condyles up toward CR (which is exactly what they do). As soon as the teeth hit the prematurity to CR on #16 the mandible would slide into an MIP position, causing the front teeth to “crash” together. This likely did not happen every time the patient closed due to muscle memory (engrams). The fact is that most patients with “hit and slides” from CR to MIP do not typically do that when asked to close their teeth together; rather, they typically close right into their MIP position. This is because the muscles have already “learned” in what order and intensity they need to contract to bring the teeth together so they fit (MIP). It is also clear to the author that most patients do, at times, close and hit the interfering tooth or teeth to CR and then slide into their MIP position. Indeed, wear facets often seen on teeth starting from the first point of contact in CR and ending at an MIP position support this contention (Figs 45 & 46). In the author’s opinion, the most likely cause for the damage to the patient’s anterior teeth initially was the severe “hit and slide” that existed prior to treatment (“it feels like I have two bites”). It was the recognition and correction of this prior to definitive restorative/prosthetic treatment that was really the key to the long-term clinical success of this case.



Figure 45: In this example the patient has tapped their teeth together in MIP. Note the articulating paper mark on #18. Also note the wear facet distal to this mark. This area was not contacting in normal excursive movements.



Figure 46: In this example, the patient was manipulated with BMM to CR. Note the first (and only) point of tooth contact in CR. The wear facet in this case was caused by a CR to MIP slide.

While an excellent cosmetic result is always a desirable goal, it was the recognition and treatment of the occlusal issues prior to doing the definitive restorative dentistry that made this case a true success.

Summary

What is needed when approaching cosmetic/restorative cases such as the one presented here is a logical and systematic methodology that will lead to a reasonably predictable final result. The place to start should always be the comprehensive exam. It is up to clinicians, through comprehensive diagnostic examination and evaluation, to develop a treatment plan that fulfills not just the esthetic but also the functional requirements of a case. While an excellent cosmetic result is always a desirable goal, it was the recognition and treatment of the occlusal issues prior to doing the definitive restorative dentistry that made this case a true success.

Editor's Note: A description of this case was originally published in the February 2007 issue of *Inside Dentistry*. It has been updated by the author.

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1. An earbow is used to record the relationship of the patient's

- a. mandibular arch in relation to the horizon.
- b. maxillary arch in relation to the interpupillary line.
- c. maxillary and mandibular arch in relation to the temporomandibular joint.
- d. maxillary arch in relation to the temporomandibular joint.

2. According to the author,

- a. a stickbite with a level is as effective in treatment planning as an earbow transfer.
- b. esthetic planes should be solely based on the interpupillary line.
- c. a correct earbow transfer accurately relates the patient's esthetic plane.
- d. restorations created to the interpupillary line typically are esthetically correct.

3. The esthetic plane

- a. can be determined in part by a line from the patient's canine to canine.
- b. is defined as the line parallel to the patient's pupils.
- c. registration is a constant and is not dependent upon the patient's posture.
- d. must always be corrected to complement facial deformities.

4. In treatment planning for harmonious occlusion,

- a. a change in morphology unrelated to condylar position will not affect occlusion.
- b. morphological change associated with condylar stability will not affect occlusion.
- c. any change in tooth form or condylar morphology is not contributory to occlusal stability
- d. any change in tooth form or position can affect condylar position.

5. In the author's opinion, centric relation

- a. is a repeatable, joint-based axial position found following splint wear and the resulting position of the teeth.
- b. is a repeatable, joint-based axial position where the condyles are in their most inferior resting position in the fossa.
- c. is totally superfluous to the location and intercuspation of the teeth.
- d. bite records are typically taken in maximum intercuspation position.

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