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LEARNING OBJECTIVES

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

- describe the benefits of approaching restorative/prosthetic cases in a comprehensive fashion.
- recognize when an alteration in the existing occlusal scheme might be beneficial prior to case treatment.
- possess a better understanding of centric relation, how to use it, and ways to find and record it.
- discuss the value of earbow transfers and properly mounted models for case diagnosis.

Is Occlusion and Comprehensive Dentistry Really That Important?

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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 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 restore a cosmetic/restorative case.

A true understanding of occlusion and comprehensive dentistry is only important if you want to become the best dentist you can possibly be. The fact is, the predictability and longevity of all the beautiful dentistry that dentists create, and the overall comfort and functioning of their patients, is predicated on just how well they understand and apply these two principles.

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 on 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 is really about seeing, and understanding, 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 often leads to patient disappointment. Conversely, esthetics without regard for function (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

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 [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 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 is not working well for that patient. It would seem logical to try and improve the occlusal/masticatory relationships in such a patient prior to, or in conjunction with, doing the restorative 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 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 was a 37-year-old woman who was referred for a consultation regarding the replacement of congenitally missing maxillary lateral incisors and improving the appearance of her teeth and smile (Figure 1 and Figure 2). She had previously consulted with a number of other dentists and had explored restorative options including implants, orthodontics, and fixed bridgework. At the age of 20 she underwent 15 months of orthodontic treatment to reposition the upper anterior teeth and to create space between the central incisors and canines. Over the past 15 years she had worn three different Maryland-type fixed bridges to replace



Figure 1 Preoperative full smile.



Figure 2 Preoperative MIP 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 teeth Nos. 8, 11, 24, and 25. All of these are potential signs of potential occlusal instability.



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the lateral incisors; at least one of those fixed bridges had composite or ceramic wings. She stated she was never happy with how any of them looked and that they would fall out occasionally. She had been evaluated for dental implants but there was insufficient space for restorations of this nature (Figure 3 and Figure 4). At the time of her initial visit she was wearing a flipper-type removable partial denture that she was very dissatisfied with, both because of the esthetics and because it caused her discomfort (Figure 5). She stated that she was very self-conscious about her teeth and smile, and often avoided smiling in photographs. Quite significantly, she also mentioned that she was not comfortable with her teeth touching and that her bite “felt off” and that sometimes it felt like she had “two bites.” She was not aware of any grinding or clenching habits. Her periodontal status was excellent. The medical history was non-remarkable. When she was asked 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 take in and out, and I would like my bite to feel comfortable because it has never felt right.”

TREATMENT PLANNING

The concept of comprehensive dentistry and the comprehensive exam was explained and discussed with the patient at her initial visit. It is often helpful to show the patient another case that has already been worked up comprehensively to help them better understand what is involved and the advantages of such an approach. A typical comprehensive exam requires about 60 to 90 minutes and includes a full set of radiographs, full maxillary and mandibular alginate impressions, diagnostic digital photographs, an earbow transfer, and centric relation (CR) and/or MIP bite records. In addition to this, a temporomandibular joint (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 (eg, CAT scan, MRI, tomogram, etc) 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 the author believes it is imperative that dentists be adept with digital photography. Quality digital photographs are essential for a number of reasons, including communication with the patient, laboratory, and the patient's insurance company;



Figure 3 Occlusal view of the upper anterior teeth showing lack of sufficient interproximal space for implants.

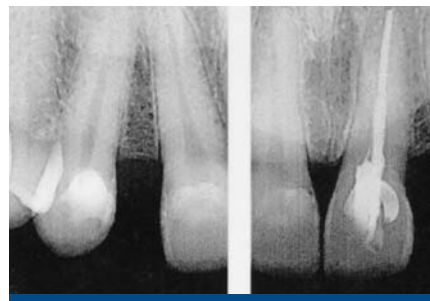


Figure 4 Radiographic appearance of the anterior teeth showing insufficient space for dental implants.



Figure 5 Photograph of the removable partial denture (“flipper”) that the patient was wearing on her initial visit.

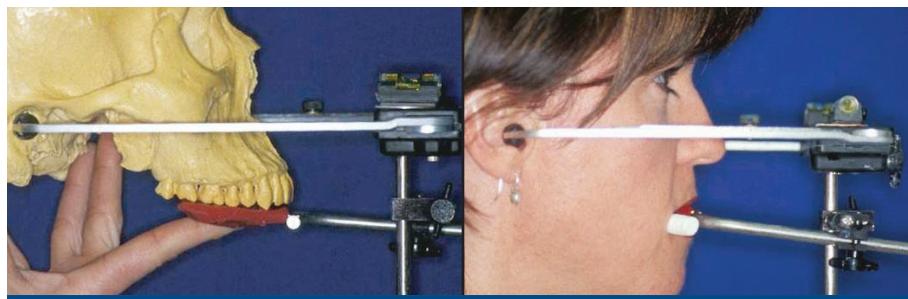


Figure 6 and Figure 7 The earbow is used to record the relationship of the maxilla relative to the TMJs. The data is then transferred to an articulator. The correct hinge axis starting position (or close approximation) is essential when taking an open bite record.



Figure 8 Try-in of a denture with a canted esthetic plane. An earbow transfer was taken and the denture was mounted on a semi-adjustable articulator (also see Figure 9).

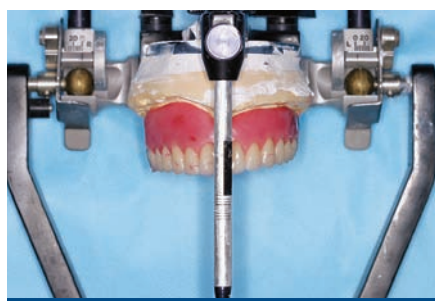


Figure 9 A properly taken earbow and upper cast mounting will enable the technician to visualize the cant as it actually appears in the patient's mouth, with the head straight and erect, allowing for easy correction (also see Figure 10).



Figure 10 Denture with the corrected esthetic plane after adjustment on the articulator.

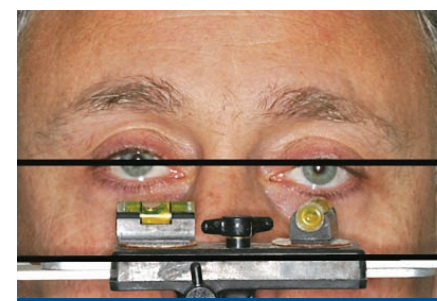


Figure 11 The author prefers to use a level to align the earbow parallel to the horizon to determine the esthetic plane. In this example, it is easy to see that if the interpupillary line was used to determine the esthetic plane, the final restorations would be canted relative to the horizon once they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

legal protection; and documentation of the case before and after treatment. Dentists should also know how to use a basic editing program for cropping and editing as required. This author will typically take a series of digital photographs, including various smile, occlusal, lips in repose, full face, and retracted views. These are then stored in individual patient folders that can be recalled at any time.

It is also essential that dentists understand how to take an earbow transfer and just why it is so important. The earbow is used to record the relationship of the patient's maxillary arch relative to the TMJ, and then transfer this relationship to an articulator (Figure 6 and Figure 7). An earbow transfer is absolutely essential whenever an open bite record is taken, as is the case with most CR bite records. The correct axis of condylar rotation (actually a close approximation) is recorded by the earbow, which is then used to mount the upper cast 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 restorations will often result in considerably more time spent adjusting the case once it is placed.

Even if the dentist chooses to take a closed MIP bite record, it is advantageous to take an earbow transfer and mount the case on an articulator. For one thing, a properly taken 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 (Figure 8 through Figure 10). In the author's opinion, a properly

taken earbow transfer is more accurate than “stick bite” type registrations for evaluating horizontal and vertical planes. The author also prefers to use a level to help determine the esthetic plane. This is achieved by having the patient sit in a chair and orienting the head so it appears level and straight relative to the horizon. The anterior bow is then moved in the horizontal plane until the bubble in the level is centered (Figure 11). 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 Although many dentists use the interpupillary line to orient the bow to determine the esthetic plane, this is often incorrect because one eye is frequently higher or lower than the other (Figure 11).

A TMJ and muscle-screening exam should 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. It

simply makes sense that we ascertain the condition of the joints prior to definitive treatment. The author uses a simple and concise 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 significant problems are suspected then other diagnostic information, such as an MRI, may be required. Stable and comfortable joints are vital to overall case comfort, stability, and predictability.

In this particular case several “red flags” were evident regarding the stability of the patient’s existing occlusal scheme. The patient had 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 TMJ screening exam, consistent reciprocal clicking (clicking on opening and closing) of the left joint was noted. In addition, the patient reported discomfort to direct palpation of the left TMJ. Lingual thinning of the upper anterior teeth and chipping and wear of the lower anterior teeth also was evident (refer back to Figure 2). Both joints could be loaded comfortably with light and firm pressure via bilateral manipulation (see

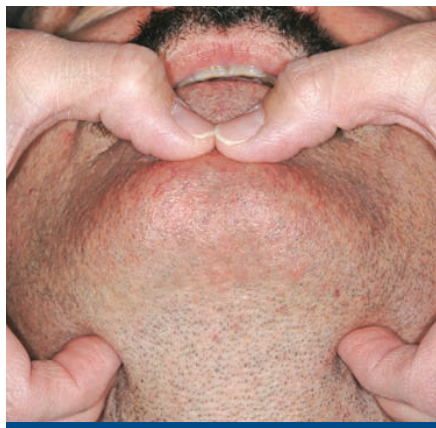


Figure 12 Frontal view of proper finger positioning for bilateral manipulation. Bilateral manipulation uses a gentle, unforced hinging movement of the mandible to seat the condyles upward into the glenoid fossa.

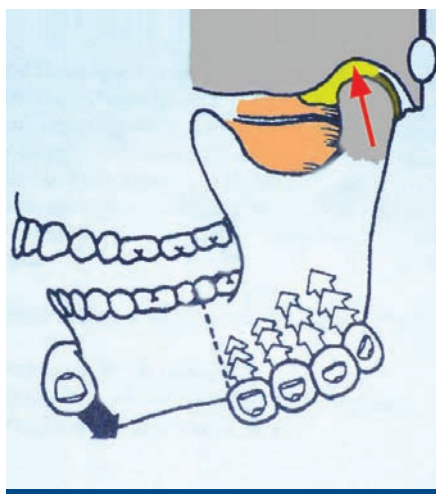


Figure 13 Sagittal diagrammatic view of bilateral manipulation demonstrating proper finger positioning and how the mandible is rotated to fully seat the condyles in their respective sockets. (Illustration courtesy of Dr. Peter Dawson.)

Figure 12 and Figure 13 for examples) but a very significant “hit and slide” from CR to MIP was noted. A “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 an MIP position (Figure 14 and Figure 15).

Centric relation (CR) 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 heads of the condyles. Peter Dawson defines CR as “the relationship of the mandible to the maxilla when the properly aligned condyle/disc assemblies are in the most anterior superior position of the glenoid fossa.”¹ What clinicians need to understand is that CR is a repeatable joint-based axial position found independently of the teeth.⁸⁻¹¹ In fact, CR bite records are typically taken with the teeth apart. In the author’s experience, CR has

proven to be a very repeatable, reliable, and useful position for case diagnosis and design, as well as in the management of many occlusal-muscular disharmonies.

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 found fairly easily in the vast majority of patients without prolonged splint therapy

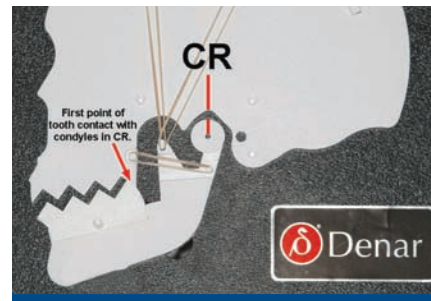


Figure 14 TMJ illustrator demonstrating the first point of tooth contact (arrow) with the condyles in CR.

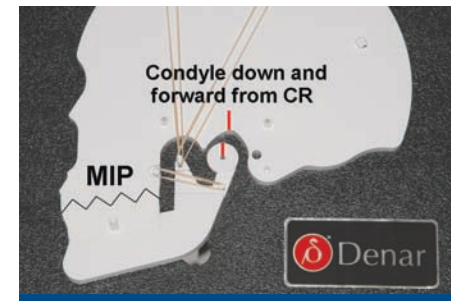


Figure 15 As the “teeth” close/slide together into MIP the condyles are no longer in CR but are down and forward from that position. This movement, from the first point of tooth contact with the condyles in CR (see Figure 14) to an MIP tooth-based position, is called a “hit and slide” from CR to MIP.



Figure 16 View of a Pankey deprogrammer that has been filled 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 Bilateral 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.



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.

(as is advocated by some). CR can be determined in any number of ways, including bilateral manipulation (BLM), leaf gauge, central bearing point and Gothic arch tracing, and various types of anterior deprogrammers such as a Lucia jig.¹²⁻¹⁶ The technique used most

often by the author is to use BLM in conjunction with a modified Pankey deprogrammer. The Pankey deprogrammer is filled with a very firm and quick setting polyvinyl siloxane (Futar® D Occlusion, Kettenbach GmbH & Co, KG) and placed over the upper anterior teeth. The surface of the deprogrammer should be kept parallel to the occlusal plane. The patient is reclined to a horizontal position, with the deprogrammer in place, for 5 to 15 minutes. The idea is to keep the teeth apart for a time to assist in muscle relaxation (deprogramming). Some patients can be deprogrammed very quickly while others require more time. Muscle relaxation, especially of the lateral pterygoids, is one of the keys to locating a correct CR position.¹⁷ To paraphrase Frank Spear, DDS, MSD (various lectures): “CR is not a position you have to put people in, it is a position the condyles go when the lateral pterygoids relax.”

After deprogramming, BLM is used to gently hinge the mandible while holding the condyles up in the glenoid fossa (CR). Using this hinging motion, the lower anterior teeth are guided through a thin layer of composite that has been placed on

the surface of the Pankey deprogrammer (Figure 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 (Figure 17). It is important to roughen the smooth surface of the deprogrammer and brush on an unfilled resin prior to placing the thin layer of composite (to ensure it sticks). If CR has been properly determined, then each and every time the mandible is hinged using BLM, the lower incisal edges will fit precisely into the incisal index. In fact, once the patient is deprogrammed no external manipulation is required 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 is closed into the index. All that remains to be done is to inject a very firm-setting PVS between the separated posterior teeth while the patient is closed into the index. The resulting bite record and index is then used to mount the case in CR on a semi-adjustable articulator (Figure 18 and Figure 19). Having taught this technique to hundreds of dentists, the author finds that most will pick up the technique relatively quickly. For those not comfortable with bilateral manipulation, the use of a leaf gauge or Lucia Jig offers a viable alternative for finding CR; however, one loses a certain degree of “tactile” information obtained from a more hands-on technique like bilateral manipulation.

In this CR-mounted case, the only point of tooth contact when the models were closed together was the mesiolingual cusp of tooth No. 16 (Figure 20 through Figure 22). This was the same first and only point of contact seen in the patient’s mouth when bilateral manipulation was used to hinge the mandible in CR (Figure 23). The fact that what we see in the mouth is duplicated precisely on the articulator confirms the accuracy of the mounting. The patient’s hit and slide from CR to MIP can be easily demonstrated by unlocking the articulator hinges and sliding the models together into an MIP position. Basically, the same thing is occurring in the patient’s mouth. In order for the patient to bring his or her teeth together into MIP, 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 may not be a clinical problem and that it is often acceptable to place restorations into an occlusal scheme such as this. Specifically, if no signs or symptoms of occlusal disharmony exist, and the patient is comfortable and has no difficulty chewing, then a change in the existing occlusal relationship may be unwarranted. Even a seriously flawed occlusion may not cause clinical problems if the patient does not bring his or her teeth together

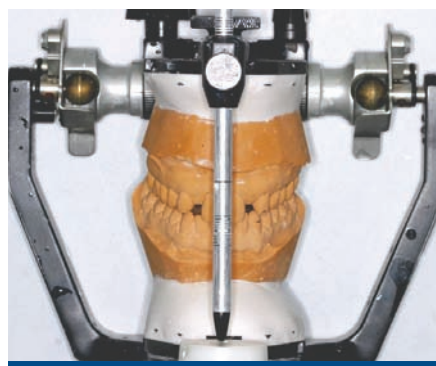


Figure 19 Properly trimmed and polished CR-mounted models on a semi-adjustable articulator.



Figure 22 In CR, the teeth on the right side are completely out of occlusion, as are all the teeth on the left side with the exception of tooth No. 16.



Figure 25 and Figure 26 Removing tooth No. 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 28 The TMJ illustrator is used to demonstrate the occlusal scheme created on the models that resulted in a new MIP position that is now coincident with CR.

very often, or brings them together with little intensity, or just has a high adaptive capacity. In the author’s opinion, it is a mistake to alter an existing occlusal scheme that is already working solely to satisfy the philosophical occlusal “ideal” of a particular occlusal philosophy. Having said that, there are many patients that have an occlusal scheme that is NOT working

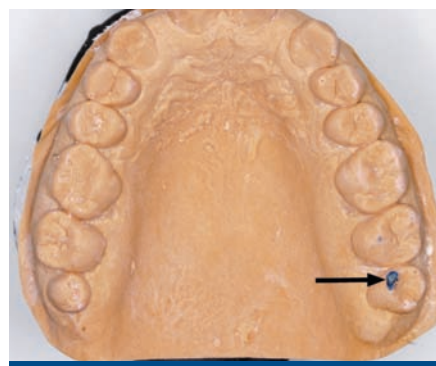


Figure 20 and Figure 21 When the models are closed together with the hinges locked in CR, the only point of tooth contact is the mesio-lingual cusp of tooth No. 16 (compare with Figure 23).



Figure 23 The fact that the same (and only) point of contact we see in the mouth using bilateral manipulation is exactly the same as what we see on the articulator confirms the accuracy of the mounting.

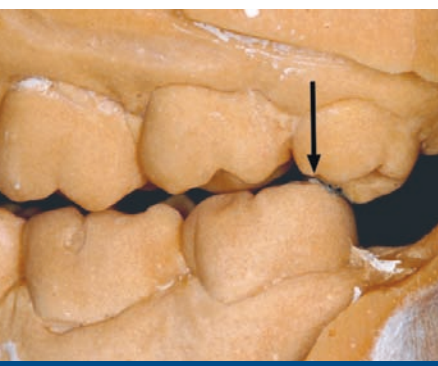


Figure 24 Tooth No. 16 is “extracted” on the model with a heatless stone.

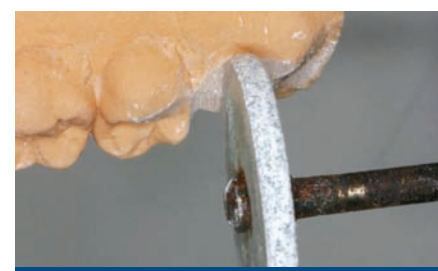


Figure 27 Anterior coupling (tooth contact) was achieved by minor equilibration of the models after tooth No. 16 was removed.



Figure 29 Diagnostic wax-up of teeth Nos. 4 through 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 As was done on the models, tooth No. 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.

well for them, and dentists need to consider a change before placing definitive restorations. The trick is to know when a change is required and when it is not.¹⁸ The clinical findings and history in this case clearly indicated a problem with the existing occlusal scheme and 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 tooth No. 16. This was essentially a nonfunctional tooth that also had mesial caries. It was decided to “extract” this



Figure 31 through Figure 33 The incisal edges of the lower anterior teeth were evened out to create a more esthetic 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.



Figure 34 Photograph of the facial reduction guide in place. It is evident that more facial reduction is required on teeth Nos. 8 and 9.

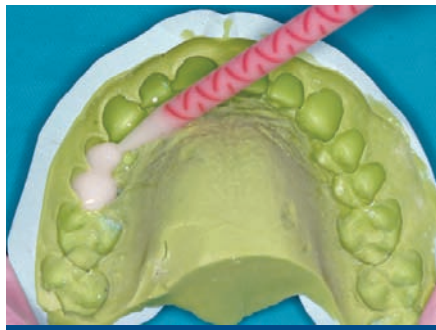


Figure 35 Matrix fabricated from diagnostic wax-up being filled with Luxatemp (DMG).



Figure 36 and Figure 37 The patient was seen 1 day after the preparation appointment so that the provisionals could be evaluated for comfort, esthetics, phonetics, and function.



Figure 38 Model showing preparations for the Lava bridges on teeth Nos. 6 through 8 and 9 through 11.

**“THIS IS THE FIRST TIME SINCE I CAN REMEMBER
THAT MY BITE HAS FELT COMFORTABLE AND
I KNOW HOW MY TEETH SHOULD FIT TOGETHER.”**

tooth on the upper model to ascertain what effect this would have on the occlusion (Figure 24). The tooth was removed with a heatless stone and the models closed together with the hinges locked in a CR position. Just removing this one tooth eliminated almost all the hit and slide from CR to MIP and bilateral posterior contacts were now evident (Figure 25 and Figure 26). Anterior coupling (anterior tooth contact) was subsequently achieved by minor equilibration of the models (Figure 27). The occlusal scheme created on the models resulted in a new MIP position that was now coincident with CR (Figure 28). By doing 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.

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. She would not accept a removable appliance of any type. She had negative experiences with three different fixed Maryland-type bridge replacements. She had very high esthetic expectations, and space management was a significant concern because of the insufficient room in the lateral incisor areas for replacement with teeth of appropriate width. After considering all of these factors and carefully evaluating the information obtained from the comprehensive exam, the following treatment plan was presented to the patient:

- 1.** Perform a diagnostic wax-up of teeth Nos. 4 through 13 on CR-equilibrated models (tooth No. 16 was removed). The wax-up would be used to fabricate a matrix for provisionals and also to fabricate reduction guides that would be used during tooth preparation. The plan would call for porcelain veneers on teeth Nos. 4, 5, 12, and 13 along with two three-unit Lava™ (3M ESPE, St. Paul, MN) bridges from teeth Nos. 6 through 8 and Nos. 9 through 11, with pontics at teeth No. 7 and No. 10.
- 2.** At the first appointment, extract tooth No. 16. Equilibrate patient to CR.
- 3.** Before the preparation appointment, the lower teeth are whitened with a take-home system (Nite White®, Discus Dental, Culver City, CA). This could be done at any time in the treatment plan, but usually it is done before the preparation appointment.
- 4.** At the second appointment, adjust and even out the lower incisal edges. Prepare teeth Nos. 6, 8, 9, and 11 for two all-ceramic Lava bridges. Prepare teeth Nos. 4, 5, 12, and 13 for porcelain veneers. Take final impressions and fabricate provisional restorations using the matrix fabricated from the diagnostic wax-up.
- 5.** At the third appointment, evaluate the patient in provisionals 1 to 2 days after the preparation appointment and make changes as required. Evaluate the provisionals for esthetics, phonetics, occlusion, and function. Once the

provisionals are deemed acceptable, an alginate will be taken of the provisionals and a solid model will be fabricated. The solid model will be sent to the laboratory along with various photographs of the patient in the provisionals to assist the ceramist in the fabrication of the final restorations.

6. At the fourth appointment, try in and evaluate the final restorations. Once the case is approved, the veneers will be bonded in and the bridges cemented in place.

7. Fabricate and insert a Durasoft nightguard/retainer at case completion (Great Lakes Orthodontics, Tonawanda, NY).

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 a matrix for provisional restorations and reduction guides to be used during the preparation phase of treatment (Figure 29). The diagnostic wax-up should be viewed as a “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 actually try the case out in provisionals that mimic the wax-up.

The treatment began by essentially duplicating what was done on the mounted models. As on the models, tooth No. 16 was extracted and the teeth equilibrated to CR (Figure 30). The patient's hit and slide from CR to MIP was completely

eliminated. The following week, the patient was re-evaluated 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 evened out to create a more esthetic profile (Figure 31 and Figure 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 (Figure 33). 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 lowers. After the lower incisal edges were reshaped, the upper canines and centrals were prepared for Lava bridges and the premolars for porcelain veneers. The reduction guides, fabricated from the diagnostic wax-up, were used to ensure adequate removal of tooth structure (Figure 34). Final impressions were taken with a polyether impression material (Impregum™ Penta™ Soft Quick Step heavy body and light body, 3M ESPE) along with a closed bite record. It should be pointed out 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 Zenith/DMG Luxatemp® Fluorescence (Zenith/DMG Brand Division Foremost Dental LLC, Englewood, NJ) B-1 shade. The matrix was filled with the Luxatemp



Figure 39 Definitive restorations (veneers on teeth Nos. 4, 5, 12, and 13 and two Lava bridges).



Figure 40 The porcelain veneers on the premolars have all been bonded in using a total-etch adhesive system protocol (One-Step Plus, BISCO).



Figure 41 Cementation of Lava bridges with a RMGI cement (Rely X Plus, 3M ESPE).



Figure 42 through Figure 44 Finished case 2 weeks after placement.



Figure 45 Patient at 14-month recall. The patient is “delighted” with her new smile and has a comfortable and stable bite relationship.

and seated over the prepared teeth (Figure 35). Once the material was set, the provisionals were removed in three sections (the veneers on teeth Nos. 4 and 5, the veneers on teeth Nos. 12 and 13, and the bridge on teeth Nos. 6 through 11) 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 of teeth Nos. 6 through 11 with TempBond® (Kerr Corporation, Orange, CA). The patient returned the day after the preparation appointment so that the provisionals could be evaluated for comfort, esthetics, phonetics, and function (Figure 36 and Figure 37). Once the case had been worked out in provisionals, an incisal index was fabricated to precisely record the incisal edge position. 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. With this information, a good laboratory can duplicate everything that was right with the provisionals in the final restorations and/or make modifications as required. Using the provisionals as a guide¹⁹⁻²⁰ is a much 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 (Figure 38 and Figure 39). 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 (Figure 40) followed by cementation of the anterior Lava bridges (Figure 41). The veneers were bonded in using the total-etch adhesive

system One-Step® Plus (BISCO, Inc, Schaumburg, IL) in conjunction with a wet-bonding protocol.²¹⁻²⁴ The veneers were sandblasted, etched with hydrofluoric acid, and treated with hydrolyzed silane before placement. There are many good resin cements that can be used for placement. Once the veneers had been placed, the Lava bridges were sandblasted with 50- μ m aluminum oxide 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. The occlusion was checked in centric closure and excursive movements, and the patient was given written and oral instructions on proper home care and maintenance. The lower teeth had been whitened prior to tooth preparation with the Nite White® Excel 3 system. The patient returned 1 week after the case was placed for final adjustments, photographs, and the insertion of a flat-plane Durasoft acrylic upper night guard. The author routinely provides nightguards in cases such as this, both for protection of the porcelain and opposing natural teeth and to act as a retainer maintaining tooth position. The patient was delighted with the final results (Figure 42 through Figure 45).

What is needed when approaching a cosmetic/restorative case 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 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.

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1. A primary tenet of comprehensive dentistry is that:
 - a. all cases should be built in centric relation.
 - b. all components of the masticatory system are intimately related and dependent on one another for ideal function.
 - c. it is only applicable in a Dawson/Pankey occlusal philosophy
 - d. it is never applicable in a Dawson/Pankey occlusal philosophy.
2. A destructive occlusal relationship can cause problems somewhere in the masticatory system, such as:
 - a. joint pain.
 - b. muscular pain.
 - c. tooth sensitivity.
 - d. all of the above
3. An earbow transfer is used to:
 - a. transfer the "esthetic plane" to the articulator.
 - b. record the correct axis (or a close approximation) of condylar rotation.
 - c. record the relationship of the maxillary arch relative to the TMJ.
 - d. all of the above
4. Any change in condylar position and/or morphology:
 - a. should be closely watched for 6 months.
 - b. will affect the patient's sense of taste.
 - c. will affect the way the teeth come together.
 - d. is potentially dangerous and should be aggressively treated.
5. Stable and comfortable joints are vital to:
 - a. case comfort.
 - b. stability.
 - c. predictability.
 - d. all of the above
6. A "hit and slide" is the terminology used to describe:
 - a. the movement of the condyles when using bilateral manipulation.
 - b. the movement seen from the first point of tooth contact, with the joints in CR, to an MIP position.
 - c. the mandibular movement when using a leaf gauge.
 - d. the force used to put the patient into CR.
7. Centric relation:
 - a. is a joint-based position where the condyles are fully seated in their most superior position in the glenoid fossa and the disks are in their proper position and orientation on the heads of the condyles.
 - b. can be found by pushing the condyles back.
 - c. cannot be found without prolonged splint therapy.
 - d. can be identified by the clicking of the TMJ.
8. An anterior deprogrammer can be used to:
 - a. assist in muscle relaxation.
 - b. keep the teeth apart.
 - c. locate the correct CR position.
 - d. all of the above
9. In the case presented in this article, the patient's "hit and slide" was demonstrated by:
 - a. taking radiographs.
 - b. manipulating the jaw.
 - c. unlocking the articulator hinges and sliding the models together.
 - d. taking an impression with a high-viscosity PVS material.
10. When adjusting lower incisal edges:
 - a. there is no need to maintain centric stops.
 - b. great care should be taken to maintain a sharp buccal-lingual line angle.
 - c. the jaw should be forced into centric relation.
 - d. first determine the curve of Spee.

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