

A Deprogrammer for Occlusal Analysis and Simplified Accurate Case Mounting



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ABSTRACT

Centric relation (CR) has been well described in the literature (a partial list of appliances and techniques include the Lucia Jig, the leaf gauge, and the bilateral manipulation technique¹⁻¹³); and, although easy to understand, it often is elusive to achieve clinically. Anyone who has attempted to mount cases in CR knows that some patients can be extremely difficult to manage for accurate bite relationships. The Kois Deprogrammer has been found to be an effective device for achieving these bite registrations. It offers a CR mounting technique and protocol that help the restorative dentist achieve predictability and accuracy. It has several other uses as well and is an invaluable tool in diagnosing the three most common types of abnormal occlusal attrition: occlusal dysfunctional, parafunction (e.g., bruxism), and a constricted path of closure (Figs 1-3).

The KD is not a proprietary appliance, and it can be made by any independent laboratory.

KOIS DEPROGRAMMER

The Kois Deprogrammer (KD) is a palatal-coverage maxillary acrylic device with a flat plane lingual to the anterior teeth. It separates the dental arches and provides a single lower-central incisor contact against the anterior bite plane. The KD can also be described as a Hawley appliance¹⁴ with a modified anterior bite plane. It is important to note that the KD is not a proprietary appliance, and it can be made by any independent laboratory.

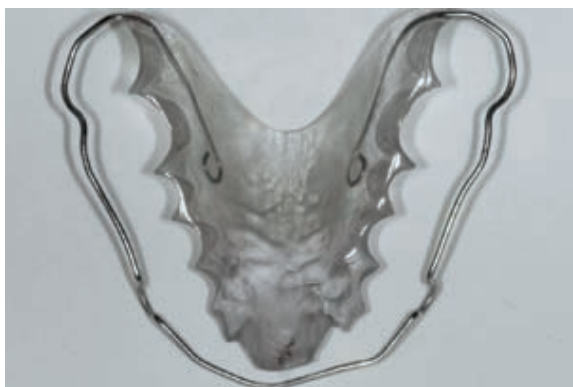


Figure 1: The Kois protocol recommends this design with a labial arch wire.

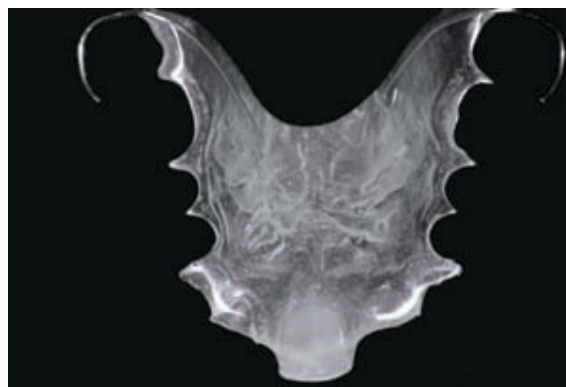


Figure 2: This design variation for the KD is useful for patients with high esthetic demands.

CENTRIC RELATION

Centric relation is described as the maxillomandibular relationship in which the condyles articulate with the thinnest avascular portion of their respective disks with the complex in the anterior-superior position against the shapes of the articular eminences.¹² This position is independent of tooth contact and is clinically discernible when the mandible is directed superiorly and anteriorly. It is restricted to a purely rotational movement about the transverse horizontal axis.

APPLICATIONS OF THE KD

Numerous clinical applications for the KD have been determined. It can be used for simplifying difficult bite registrations and for accurate mounting of diagnostic casts, for patients that are difficult to manipulate into CR, and for facilitating occlusal adjustments (during which time it is worn). The KD can be used as a diagnostic tool to determine if the mandible needs to move in the anterior or posterior direction to reach CR from maximal intercuspal position (MIP). The device is also used to differentiate among three types of abnormal occlusal attrition:

- Constricted path of closure (CPC): Attrition occurs during closure into MIP when anterior interferences create a distal thrust that moves the condyles distal to CR (Fig 4).
- Occlusal dysfunction: Occlusal attrition as a result of excessive grinding triggered by interferences on the posterior teeth (Fig 5).
- Parafunction (true bruxism): Occlusal wear as a result of excessive grinding triggered by the brain. It has no functional purpose.

It is worn until the necessary muscle deprogramming is accomplished and can be worn for days or weeks if necessary.

FEATURES AND BENEFITS OF THE KD

The KD appliance is designed such that it can be worn for extended periods of time, as long as it does not exceed 20 hours per day. It is worn until the necessary muscle deprogramming is accomplished and can be worn for days or weeks if necessary (the usual course is for

one week). If the patient is not completely deprogrammed by that time, it may be necessary for the patient to wear the deprogrammer for up to 24 hours per day (except when eating). In this case the duration should be limited, preferably no longer than one week. This is to prevent potential supraeruption of the posterior teeth or intrusion of the contacting incisor.

Many types of appliances and techniques can be used to attain CR.^{1,2,7-9,15} The KD has a number of features and benefits that make it an ideal protocol for obtaining CR or managing a number of occlusal issues:

- It allows for the patient to deprogram over time. It has been shown that in patients with a centric prematurity introduced for a short period of time, a percentage of them may take days or weeks to lose the muscular discoordination in the muscles of mastication once the prematurity is removed.¹⁶ This explains why some patients will not deprogram instantly or in a few hours. In these cases, an accurate record cannot be taken



Figure 3: The appliance is stabilized by the palate and arch wire or clasps.

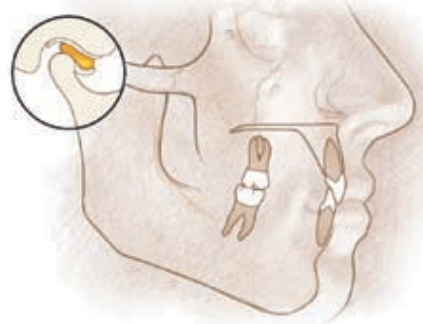


Figure 4: Anterior interferences cause the mandible to shift distal to CR.

until they have been completely deprogrammed.

- The jaw is not manipulated into CR, but is determined by the patient and is reproducible. This is a key criterion to determine if the patient is deprogrammed. The patient must be able to close into the same position every time, passively, without any guidance or external force.
- The patient can be observed when closing into a reproducible CR mark. This position can again be verified when the bite registration is taken. The patient should make the same mark on the appliance during the bite registration as was made during the initial recording.
- The bite registration is taken with the appliance in place. This allows great control of the vertical dimension of occlusion (VDO) during bite registration (Fig 6).
- It is used to facilitate an occlusal adjustment once the deprogramming is complete. The same appliance can be used. Use of the KD ensures that the deprogramming will be

maintained during the occlusal adjustment (Fig 7).

- It can be worn at a minimally opened VDO of approximately 1 mm in the molar region. This closed position is often more comfortable than appliances that require a much greater VDO. This also makes the appliance more esthetic if needed for daytime use.
- It is self-adjusting. There is only one incisor tooth contact against the appliance. As the muscles relax, the condyles are free to move with no obstacles to prevent them from achieving an equilibrium position in CR. This saves multiple adjustment appointments.

The CPC patient often can fool the clinician; he or she may be asymptomatic, easy to manipulate, and give reproducible mountings.

HOW DOES IT WORK?

Proprioceptors in the periodontium provide feedback that programs the muscles to close in MIP. Without reinforcement through repeated

tooth contact, the feedback and the influence of the dentition on the condylar position is lost. Tooth-deflecting inclines can trigger discoordination of the masticatory muscles. Until these muscles relax and function in a coordinated manner, the patient may be incapable of achieving a CR position. The KD breaks this cycle by discluding the teeth and allows the muscles to return to normal function. The KD protocol also verifies that the muscles of mastication are deprogrammed. This ensures that the condyles are allowed to "move" to the CR position, being unaffected by uncoordinated muscles, tooth interferences, or operator error.

DISCUSSION

The "classic" patient for an anterior appliance is one who is experiencing obvious muscle disharmony and is very "tight" or difficult to manipulate. There are other cases, however, that appear easy to manipulate into CR and yet require the extended deprogramming time in order to achieve the CR position. The question is, "Which patients are they?" This can be difficult to answer.

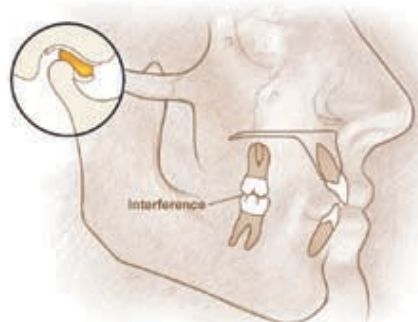


Figure 5: Posterior interferences can precipitate grinding as well as avoidance patterns. This can lead to significant attrition of the anterior teeth.



Figure 6: The initial point of contact can easily be visualized during evaluation of deprogramming and for the bite registration.

The CPC patient often can fool the clinician; he or she may be asymptomatic, easy to manipulate, and give reproducible mountings. Testing these patients with a deprogrammer will verify the achievement of CR.

Patients that potentially fall into the CPC category include those with a deep overbite, a steep interincisal angle, those that have been over-closed during occlusal adjustment, post-orthodontic patients, patients with overcontoured anterior restorations, and patients who have been previously restored in CR. It has been the author's experience that these CPC patients (those with condyles positioned posterior to CR in MIP) comprise a significant percentage of the population. Many of these patients were easy to manipulate using bilateral manipulation or anterior discluding devices, gave reproducible mountings, and then shifted significantly forward during deprogramming with the KD.

Accurate mounting allows for an accurate diagnosis. This is important as CPC patients are at significant risk for damaging their anterior teeth and restorations (Fig 8). They may also develop muscle or joint symp-

toms. These patients are forced to continually adapt to this position. If their ability to adapt is diminished, possibly from stress or trauma, they run a much greater risk for becoming symptomatic. These patients function on the lingual surface of the maxillary incisors during mastication. They may develop significant wear on both the lingual surfaces of the maxillary incisors and on the labial surfaces of the mandibular incisors. The CPC must be corrected in order to alleviate this risk.

Patients functioning anterior to CR are at a lower risk for becoming symptomatic as there is more "give" to the system. These patients, however, may develop significant attrition as a result of grinding caused by posterior interferences (occlusal dysfunction). This excessive attrition can be stopped by correcting the occlusal interferences. This will lower the restorative risk as well.

The KD is useful for diagnosing between three types of abnormal attrition (CPC, dysfunction, and parafunction [bruxism]). CPC attrition occurs during closure into MIP, and mastication. Dysfunction-al attrition occurs throughout the entire day. Neither of these patient

groups will grind on the KD, as the etiology of the grinding has been removed (i.e., once the patient has been deprogrammed). If the patient does develop a wear facet on the anterior discluding device, by process of elimination, the attrition is caused by the parafunction habit (Figs 9 & 10). (Note: There is a fourth category of patients who have a neurological disorder. Fortunately, they are relatively few in number. They will usually present with an underlying medical diagnosis and can be very difficult to manage.)

Making this distinction is important because each diagnosis requires a different type of treatment. The CPC patient can be the most difficult to manage. Correction of this problem will require that the jaw come forward to CR. This means the maxillary and mandibular anterior teeth must be moved out of the way. This can be done by moving the maxillary anterior teeth to the labial; moving the mandibular anterior teeth to the lingual; opening the bite; shortening the anterior teeth; reducing on the labial of the lower anterior teeth; or, in some cases, moving the jaw.

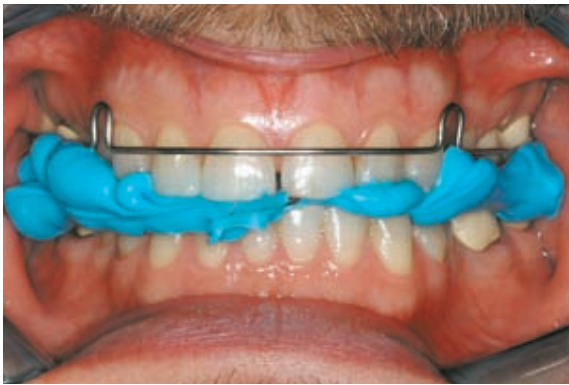


Figure 7: Facial view demonstrates how the patient can be significantly closed during the bite registration.



Figure 8: CPC patients can cause significant attrition on anterior teeth. These patients often cause significant damage to anterior restorations.

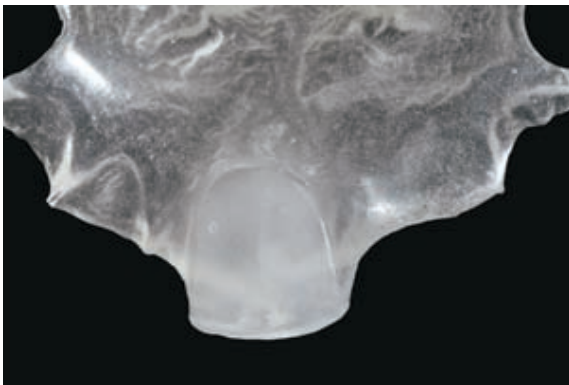


Figure 9: A satin finish aids in the rapid diagnosis of wear facets on the device.

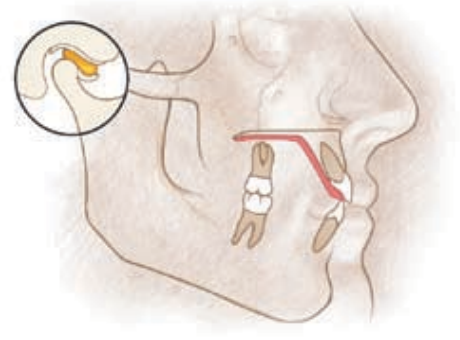


Figure 10: The KD is an anterior discluding appliance and can be used to help manage accurate bite relationships.

The patient with dysfunctional attrition is managed by removing the interferences. This may be very simple to treat, often with only an occlusal adjustment. It can also, however, be more complex. The bruxism patient is managed with a biteguard, as the bruxism cannot be stopped by occlusal therapy.¹⁷ The occlusion can also be modified to redistribute the occlusal forces.

DEPROGRAMMER PROTOCOL

The deprogrammer is inserted on the maxillary arch similar to a maxillary Hawley appliance. The an-

terior platform should be adjusted horizontal to the occlusal plane. The single mandibular tooth contact should be as close to the midline as possible. There should be only one point of contact. The platform should not cause the mandible to deviate laterally (Fig 11). It should allow the mandible to move freely in an anterior, posterior, and lateral direction. The surface should be flat and should extend far enough anteriorly and posteriorly that the patient cannot lose contact with either end. The platform should be thick enough to prevent contact with the

opposing teeth when the patient relaxes into CR. Approximately 1 mm of clearance should remain, and the clinician should be sure to check. If the platform is too thick, some patients can develop vague muscular pain. Do not make the platform any thicker than is necessary (Table 1).⁶ The patient should not wear it during meals or wear it so much that it causes quality-of-life issues. The patient should be cautioned to discontinue use and to contact the practice if he or she experiences increased pain, which may indicate an intra-capsular problem.⁶



Figure 11: The platform should facilitate a passive anterior-posterior slide without deviation. This is evaluated with articulating paper.



Figure 12: The pattern seen here is typical of a patient who is not deprogrammed. This patient will need to wear the appliance for a longer period of time during the day.



Figure 13: This patient has been successfully deprogrammed and is ready for bite records.

WHEN IS THE PATIENT DEPROGRAMMED?

The patient is deprogrammed when he or she reproduces the same single spot on the platform without guidance or support. The spot needs to be absolutely flat with no slide whatsoever and the spot must be repeatable. The patient should be asymptomatic and will know when he or she continues to contact the same spot on a tooth immediately after removing the KD. Patients marking in more than one place are not deprogrammed. They will then need to wear the deprogrammer more hours per day, or for more days

(Figs 12 & 13). Make sure that the patient is not hitting any teeth as he or she moves toward CR.

CONTRAINDICATIONS

Contraindications include any patients with joints that will not accept loading. A patient who cannot accept loading indicates that there may be a capsular problem. The KD contacts only in the incisal region and, as with all anterior splints, places most of the bite force on the temporomandibular joint. A simple test to diagnose this is to place cotton rolls between the anterior teeth and have the patient squeeze. Pain

in the joint indicates that the patient cannot accept loading.

SUMMARY

The KD offers an easy CR mounting technique and protocol that help the restorative dentist achieve predictability and accuracy in an area that can be very difficult. Deprogramming the patient can take time and for that reason, it may be extremely difficult to obtain a true CR position without deprogramming certain patients. Patients that require deprogramming can be difficult to diagnose in advance.

Fabrication Protocol for the Kois Deprogrammer⁶

- Make stone, full-arch casts of the maxillary and mandibular arches.
- These casts should be mounted in a maximum intercuspal position.
- Bite records and facebows are not necessary.
- Fabricate labial bows to extend from the most distal tooth on each side of the arch. There should not be any wires to interfere with the occlusal surface.
- Complete full-palatal coverage with acrylic to allow for complete intercuspation of all teeth initially.
- Add a small anterior stop opposing the lower central incisors that slightly discludes all teeth.

The laboratory should note that the anterior platform (i.e., bite discluder) should be added after the palatal-coverage portion has been fabricated. This will save extensive acrylic grinding later if completing the occlusal adjustment with the appliance.

Table 1

The KD has other uses that are very helpful to the restorative dentist. Diagnosis of the accurate condylar position is important in developing a proper treatment plan. Accurate diagnosis is critical especially for CPC patients. If a patient needs to come forward to develop a stable jaw position, this can have a dramatic effect on the treatment plan. The KD allows diagnosis of the three types of abnormal occlusal attritions (each having a different treatment protocol). Finally, the KD simplifies occlusal adjustments as it can be worn during the occlusal adjustment to maintain deprogramming throughout the adjustment. The many features and benefits of the KD make it a powerful tool to increase predictability of diagnosis and treatment.

Acknowledgment

The author thanks Dr. John Kois for allowing him to adapt portions of his manual.

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