

Occlusion

[Why Porcelain Breaks](#)

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Ten Factors to Consider in the Restorative Process

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We have all experienced it. It could have been a single posterior ceramic restoration or a smile design case involving multiple anterior units. The case goes to place with ease, the shade is perfect, only minor adjustment was required at delivery, and the patient leaves the office thrilled with the result. Then, the dreaded phone call: An unhappy patient called to report a broken restoration. At best, the patient returns to the practice to have the problem fixed, creating unproductive time for the patient, dental practice, and dental laboratory. At worst, the patient loses confidence with the dental team, wants his or her money back, and leaves the practice. Either way, good will is lost, and referrals are not likely.

While it is unrealistic to eliminate completely this kind of dental emergency from the practice of dentistry, this article reviews some of the key principles of the Dawson Philosophy. When these principles are followed, they will guide the restorative team in providing the patient with restorations that are contoured properly to live in harmony with the joints and muscles. Restorations designed with these principles in mind dramatically decrease the chance of postcementation failure, just about eliminating these problems.¹ Having a thorough understanding of the gnathostomatic system is critical if a consistent, predictable result is to be obtained by today's dental team. Predictability is the cornerstone of the Dawson Philosophy.

By the conclusion of treatment, any factor that could contribute to the breakdown of the dentition should be eliminated. Dr. Dawson has taught that a mouth can break down from the lack of control of microbes or the lack of control of occlusal forces. Following a protocol to return the tissues to health, providing restorations that can be easily and thoroughly cleaned by the patient, ensuring occlusal contacts are in harmony with the gnathostomatic system, and creating an optimum esthetic result are the primary goals of the Dawson Philosophy.

When a patient's dentition breaks down, one of the signs of instability that is becoming more common in dentistry is the fracture of porcelain. This article discusses the Top 10 reasons to consider when fracture occurs.

1. Properly Designed Centric Stop²

There are two distinct purposes that equal-intensity centric holding contacts play in the ideal occlusal scheme. The first is to distribute equally throughout the mouth whatever force the patient can generate. Force distribution is a timing issue. Figure 1A ([View Figure](#)) illustrates what appears to be an ideally adjusted occlusion. When using articulating paper, the dots on the teeth represent the sum totality of the time it takes for the teeth to occlude and disclude in centric relation (CR). Figure 1B ([View Figure](#)) illustrates the same occlusal pattern using the T-Scan® III (Tekscan Inc, South Boston, MA), a computerized occlusal scanning

device which allows clinicians to look at occlusal force distribution in 1/100th of a second increments in time. Notice that teeth Nos. 5 through 8 and 15 are hitting first. These technological advances can provide very useful information when fine-tuning a patient's occlusion.

The second purpose of the centric stop is to create both vertical and horizontal stability of the teeth. An inappropriate stop (one that is on an incline) or the lack of a stop will allow the teeth to drift vertically or horizontally. Teeth that can drift are not stable. The following are the rules to be considered regarding centric stops within the Dawson Philosophy.

Posterior Teeth

The goal is a cusp-fossa occlusal relationship. Allow the stamp cusps (buccal of lower, lingual of upper) to land on a marginal ridge or in a central fossa. Avoid incline contacts, because they will allow teeth to shift. The eruptive force is ever-present, thus teeth will migrate to a point where they will no longer erupt. When adjusting restorations or natural teeth, a good rule of thumb is always to sharpen the stamp cusp, moving it toward the central fossa or marginal ridge. Adjusting cusp tips rather than opening up fossas will help conserve tooth structure and minimize the adjustment.

A porcelain restoration that is left high or with a poorly designed stop will lead to porcelain that is overloaded. Often the first sign of instability of an all-ceramic restoration is fracture.¹ It behooves us to be meticulous in evaluation of centric stops with extremely thin articulating paper (AccuFilm® II, Parkell, Inc, Edgewood, NY), shim stock, and technologies such as the T-Scan III.

Anterior Teeth

The goal is to have a centric stop or an acceptable substitute. Some occlusal philosophies still advocate very light centric stops to prevent overloading the anterior teeth when the jaw moves. However, for the anterior teeth to carry their percentage of load and to prevent eruption/drift of the anterior teeth, the Dawson Philosophy dictates equal-intensity stops with the posterior teeth. The only time incisors are left out of contact is when the patient presents with an open bite, in which the teeth have not erupted. In these cases, the tongue is an acceptable substitute because it will prevent eruption.

2. Correct Lateral Anterior Guidance³

When the mandible moves laterally, the goal is to have immediate disclusion of the posterior teeth on the working and balancing side (Figure 2 [View Figure](#)).

Anatomically, the cuspids, which are at the corners of the arch, have the longest roots in the mouth and are located far from the condyles, making them a great choice to build the guidance. The classic work by Williamson and Lunquist illustrated the neuromuscular advantage obtained when posterior teeth are not allowed to contact in excursive movement.³ Quite simply, when back teeth bump, not only is the lateral force closer to the fulcrum creating additional load to the teeth, but also more muscle fibers are called into play.

Posterior Teeth

If the condyles are in CR and the posterior morphology is flatter than the anterior guidance, the posterior teeth will disclude.¹

Anterior Teeth

Creating the correct contour on the lingual of the maxillary canines is one of the most important decisions a clinician makes during the restorative process. While the lingual contour needs to be steeper than the posterior morphology, it is possible to make it too steep. These contours should be worked out in provisional restorations, providing the patient customized anterior guidance (Figure 3 [View Figure](#)). A cross-mounted model of the provisional will need to be provided to the laboratory to copy. This step is critical for a predictable, successful outcome.

When posterior teeth are allowed to contact in excursive movements, increased muscle activity, combined with the increased mechanical stress of being closer to the fulcrum, contributes to increased chance of fracture. Creating noninterfering posterior teeth is one of the primary tenants of a stable occlusion. Additionally, if the cuspids are too steep for the functional pattern of the patient, fracture, mobility, or migration is likely.¹

3. Correct Protrusive Anterior Guidance³

With any protrusive movement of the mandible, the goal is immediate posterior disclusion. Just like lateral movements of the mandible, posterior tooth contact in a protrusive movement increases the force on the anterior teeth because of increased muscle activity.¹ Like lateral anterior guidance, the quality of the contour is extremely important and needs to be worked out in provisional restorations. The lingual contour has to be steeper than the posterior morphology, but easily could be made too steep. Steep guidance patterns restrict the movement of the mandible that can lead to instability; fracture being one of the possibilities.¹

As the mandible moves forward, the goal is to have equal contact of the leading edge of the lower incisors from the centric stop to the maxillary incisal edge. Balancing the protrusive load over the lingual contours of the central and lateral incisors is key to comfort and stability of anterior esthetic restorations.¹

4. Correct Crossover Disclusion⁴

In lateral excursions, as the patient goes beyond the cuspid, proper occlusal design dictates that there is a smooth transition to the incisal edge of the maxillary centrals. This transition requires the proper alignment and position of the mandibular as well as the maxillary incisors. When this positioning is overlooked, excessive loads can be placed on the distal of the lateral incisors, leading to fracture. It is not by chance that the most common anterior esthetic restorations to fracture is maxillary lateral incisors.¹

5. Lingual Contours in Harmony with the Envelope of Function¹

Protecting the posterior teeth from contact in excursive movements is one of the most important functions of the anterior teeth. Working with the condylar guidance, the lingual contour must be steep enough for immediate separation of the posterior morphology. Equally as important is a lingual contour that is concave enough to be in harmony with the functional envelope of the mandible.¹

Some patients' functional patterns are steep while other patients' are more horizontal (Figure 4 [View Figure](#)). Signs of instability such as wear, fremitus, or

migration of the anterior teeth are all indications that a constriction could be occurring. Working in CR, combined with a customizing of the lingual contour for the patient's functional pattern, is critical for long-term success.¹ A three-step process can be used to adjust maxillary provisional restorations.

- **Step One:** Create equal-intensity holding contacts in CR (Figure 5A [View Figure](#) and Figure 5B [View Figure](#)).
- **Step Two:** With the patient in a seated position, use a hands-off approach and a different colored paper to mark the articulation as the patient opens and closes (Figure 6 [View Figure](#) and Figure 7 [View Figure](#)). Note: The mandible will open and close on an outside-in stroke, following the functional pattern of the patient.
- **Step Three:** Adjust the long centric marks, being careful not to touch the centric stops (Figure 8 [View Figure](#)). This adjustment allows the patient to chew in CR or posture forward without running into the anterior teeth.¹ Key Point: When customizing the anterior guidance, many dentists fail to recognize how working in CR can provide the necessary horizontal freedom of the mandible.

6. Parafunction¹

Bruxism, nail biting, sleep disturbances, chewing on pencils/pens, or any aberrant movement of the mandible that brings the teeth together in an abnormal pattern and creates signs of instability in any part of the system need to be identified during treatment planning. If it is identified that the parafunctional issues happen while the patient is asleep, a night guard should be fabricated to cover the teeth during this time. If, however, the issue is during the day, every effort should be made to help the patient break the habit before restoration.

7. Properly Designed Tooth Preparation⁵⁻⁷

Specific parameters with regards to tooth reduction need to be followed when preparing teeth for ceramic restorations. When a veneer or crown is bonded to place, it is the underlying tooth that supports the porcelain. One of the most common causes of fracture is overreduction of the incisal edge. Porcelain that has > 2 mm of unsupported material is at risk for fracture.⁵⁻⁷ This length can result if the restorative dentist does not plan the length of the new restorations carefully. For example, if the patient requires 1.5 mm of additional length for ideal esthetics, only 0.5 mm of incisal reduction will be required. If, however, the dentist does a "standard 2-mm reduction" when preparing the anterior teeth and then adds 1.5 mm of length, 3.5 mm of unsupported porcelain will exist at the incisal edge, which will be at risk for fracture.

Proper treatment planning with mounted diagnostic casts, photographs, radiographs, and a complete examination process will allow the restorative team to create a three-dimensional vision via diagnostic wax-up. The wax-up will not only provide vision for the case, but also allow the creation of preparation-reduction guides that ensure the preparation reduction goals are met. These pretreatment procedures dramatically increase the predictability of the restorative process.

8. Properly Finished Tooth Preparations⁸

All-ceramic dentistry requires a high degree of precision in both reduction and

finishing. Sharp line angles and rough preparations are some of the major contributing factors when fractured porcelain occurs. When a sharp line angle is left on a preparation, this sharp point will not get transferred properly to the die, leading to a porcelain restoration with a rounded internal surface that abuts the sharp line angle. This abutment creates tremendous stress on the porcelain substructure, and when combined with poor occlusal management, may lead to fracture.⁸

Along with proper reduction, a combination of finishing burs, discs, and cups should be used to properly finish each preparation. Proper finishing will lead to cleaner impressions as well as better fitting, fracture-resistant restorations.

9. Meticulous Adhesive Technique⁹⁻¹³

While the specifics of adhesion is beyond the scope of this article, poor attention to detail during the delivery phase of all-ceramic restorations is a major cause of postoperative discomfort and fracture.¹³ It is crucial that the restorative dentist and dental assistant learn to use their dental material of choice and carefully orchestrate each step of the adhesive process.

10. Trauma¹⁴

The active lifestyles of many patients can and will put esthetic restorations at risk. Spending a little time interviewing each patient to find out potential sources of trauma, either through leisure or job-related activities, is a very good idea. If such a risk is identified, then the use of an office-fabricated sports guard should be provided for the patient. It is also a good idea to consider taking posttreatment records, including mounted diagnostic models, and give them to the patient to store. In the event trauma should occur, these models can be invaluable in re-creating the patient's restorations.

Conclusion

While there are many factors that contribute to the fracture of a restoration, this article has reviewed 10 of the more common principles that should be considered when treatment planning anterior and posterior restorations. Keep in mind that—while fracture is a sign of instability that a patient is acutely aware of—tooth mobility, tooth migration, tooth wear, sore musculature, and temporomandibular joint issues also can be a consequence if occlusion is not meticulously addressed. The Dawson Philosophy provides a step-by-step process to provide outstanding esthetic results with a tried-and-true approach to providing occlusal stability.

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FIGURE 1A Properly adjusted occlusion, exhibiting equal intensity contact on all teeth.

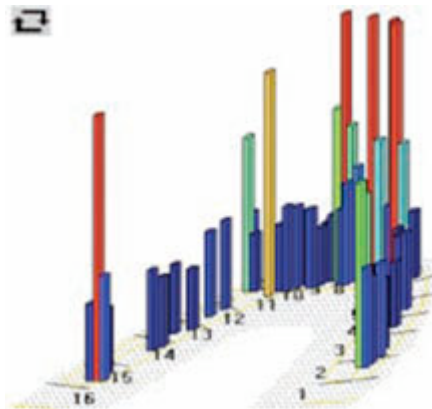


FIGURE 1B T-Scan of the occlusal scheme in Figure 1A. These technologies allow us to work to higher degrees of accuracy.



FIGURE 2 Correct lateral anterior guidance should exhibit no posterior contacts during excursive movements.

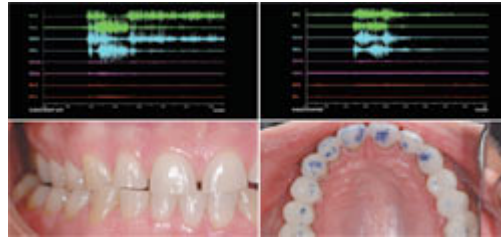


FIGURE 3 Comparison right lateral.

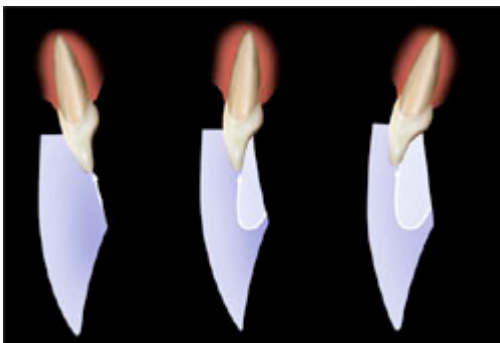


FIGURE 4 Multiple functional patterns allow for anterior guidance to be in harmony with the envelope of function.

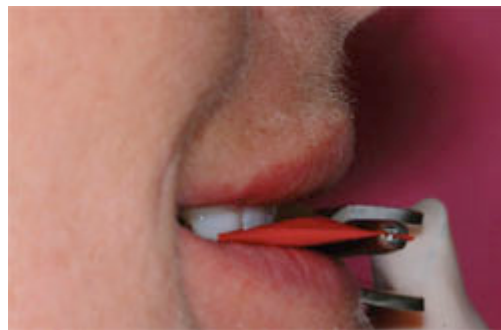


FIGURE 5A AND 5B Long centric is determined by (A) the CR position and (B) checking “long centric.”



FIGURE 6 Key Point: The long centric is an outside-in closing pattern that is seen in chewing and speech. It is critical to check the patient's centric stops with a hands-off approach with the patient sitting up. This approach allows for precise refinement when customizing the lingual contour.



FIGURE 7 Long centric "red marks" are the interferences with the envelope of motion.



FIGURE 8 Key Point: Adjusting for long centric customizes the lingual contour, creating harmony with the envelope of function.

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