CE Test 52.1

AESTHETICS

Considerations for Establishing and Maintaining Proper Occlusion in the Aesthetic Zone

By William P.D. Wynne, DDS

Restorations placed in the aesthetic zone can be protected by following the rules of occlusion. This article outlines these rules and illustrates their application to restorations placed in the aesthetic zone.

In the past few years, attention has been given to the occlusion of aesthetic restorations. The anterior dentition is of paramount importance when reconstructing the stomatognathic system. The primary and permanent anterior teeth erupt into contact first, and establish the anterior stop for the mandible. This allows the posterior teeth to erupt into position at the proper vertical dimension and centric relation.[1]

Anterior guidance is provided by the lingual contours of the 6 maxillary anterior teeth as they contact the facial aspect of the 8 mandibular teeth in centric occlusion as well as in protrusive and excursive movements.[2]

Restorations placed in the aesthetic zone can be protected by following the rules of occlusion. This article outlines these rules and illustrates their application to restorations placed in the aesthetic zone.

The purpose of anterior guidance can be considered to be protection of the posterior teeth from excessive lateral force. Posterior teeth are better suited to accept vertical versus lateral forces. Lateral forces placed on posterior teeth can result in a fracture or excessive wear. Pure vertical forces are the least damaging to these teeth because the force will be absorbed by the greatest surface area of the periodontal ligament.[3]

Lateral forces should be directed toward the anterior teeth, especially the canines, due to root length and the position of these teeth at a distance from the temporomandibular joint. The closer to the joint or fulcrum, the more

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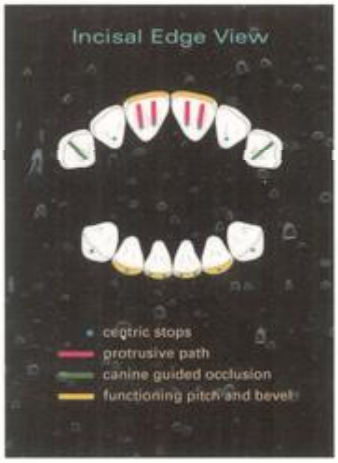

Figure 1. Incisal view of the maxillary and mandibular teeth showing proper occlusal pattern of function in a canine-guided occlusion.

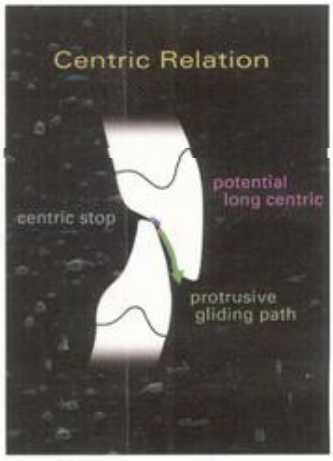

Figure 2. View of centric relation.

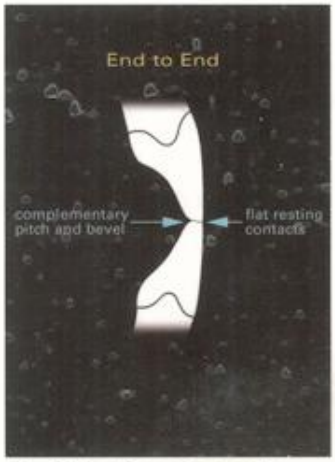

Figure 3. View of the end-to-end position.

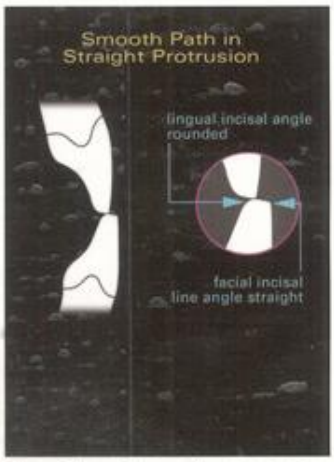

Figure 4. View of the smooth path in straight protrusion.

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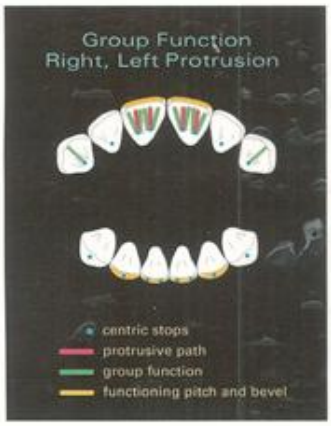

Figure 5. View of group function (right, left protrusion).

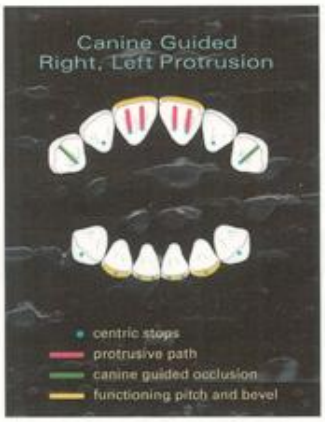

Figure 6. View of canine-guided occlusion (right, left protrusion).

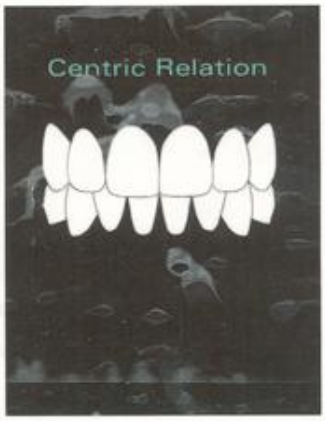

Figure 7. View of centric relation.

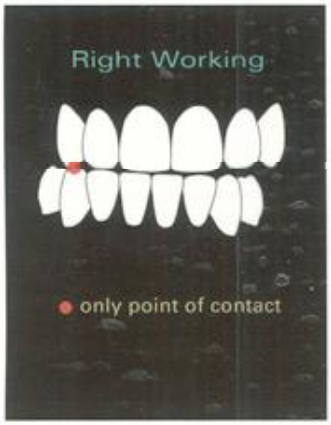

Figure 8. View of right working contact.

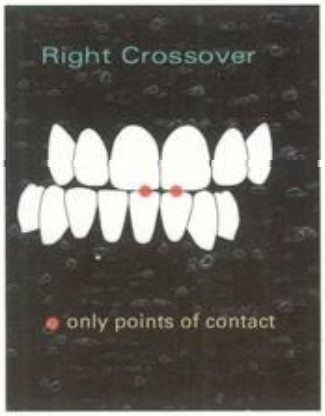

Figure 9. View of right crossover contacts.

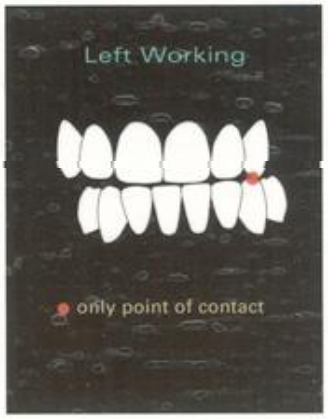

Figure 10. View of left working contact.

force that can be transmitted. The position of the canines toward the anterior of the mouth reduces the amount of force on these teeth.[4] Canine-protected occlusion also reduces the chance for temporomandibular dysfunction, since it reduces lateral tooth contact and the possibility of interfering contacts. Consequently, the chance of muscular dysfunction is reduced.[5]

The canines are often considered the primary protectors of the gnathologic system because they direct a vertical (rather than a horizontal) masticatory pattern.[3] Without this protection, damaging horizontal forces can severely wear the posterior occlusion.

In regard to aesthetic reconstructions, clinicians must attempt to control the forces that can be applied to the dentition. The anterior teeth disclude the posterior teeth in all movements of the mandible. Therefore, damaging horizontal or lateral forces on the posterior teeth are minimized or eliminated. Harmonizing the lingual contours of the maxillary anterior teeth with the facial contours of the mandibular incisors and the neuromuscular system is the single most important factor in the health and stability of the occlusal system.[6] Restorations placed in the aesthetic zone can be similarly protected by following some fundamental rules.

COMPONENTS OF PROPER ANTERIOR GUIDANCE AND OCCLUSAL MORPHOLOGY PATTERNS

In a proper canine guided occlusion, there are 2 centric stops on each of the central incisors and one stop on each lateral incisor and canine. During straight protrusive occlusion, 2 paths are evident on each central incisor on the lingual marginal ridge region. Occasionally there may be anterior protrusive marks on the canines. The paths on the central incisors extend until the incisal edges of the 2 maxillary central incisors and 4 incisal edges of mandibular incisors are engaged. At this point, these teeth should be able to slide smoothly (Figure 1).

In the centric relation position, the relationship between the maxillary incisors and mandibular incisors becomes clear (Figure 2). The facio-incisal leading edge of the mandibular incisors engages the lingual aspect of the maxillary incisors and canines. To maintain this relationship in a reconstruction, it is necessary to hollow out approximately 0.5 mm of space on the gingival aspect of the centric holding marks. This provides the freedom to close the mandible either into centric relation or slightly anterior without varying the vertical dimension of the anterior teeth.[6]

The end-to-end position is indeed a rest position. Here, the pitch of the maxillary and mandibular teeth is complementary, allowing the maxillary central incisors and 4 mandibular incisors to function in the same plane (Figure 3).

To create a smooth path in straight protrusive and when moving into the crossover position, the lingual incisal line angle of the mandibular incisors should be polished or rounded in order to create a smooth transition from the incisal edge onto the lingual aspect of the teeth (Figure 4). In addition, there should be no rough edges on the lingual incisal aspect of either mandibular canine; these areas should also be rounded. These considerations will help create a smooth, friction-free transition in all functional directions.

Establishing ideal distribution of stress on the anterior teeth in lateral excursion (anterior guidance) can be accomplished by either group function (Figure 5) or canine guidance (Figure 6). If group function exists, there is no need to create canine guidance. In this case, changing to canine guidance would increase the force on the canines, which may destabilize the system.[7] If canine guidance exists and there is no tooth mobility or alveolar bone loss, then rebuilding canine guidance is appropriate.[7]

The next consideration in development of the occlusion is lateral movement into what is called the crossover position, which is defined as the portion of the occlusal path after the canines have contributed their support and the incisors then assume the support. The functional path is a smooth, lateral movement until the tips of the canines are in contact.

After this point, the canines glide smoothly over the polished and rounded lingual aspect of each tooth until the support is transferred to the incisal edges of the maxillary incisors. This transition should be a smooth, gliding path (Figures 7 through 11).

CASE PRESENTATION

A 28-year-old female presented with a shift in the maxil-

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Figure 11. View of left crossover contacts.

Figure 12. Preoperative view of the patient's condition.

Figure 13. Postoperative view of the patient.

Figure 14. Postoperative view of the patient in protrusive occlusion.

Figure 15. View of the patient's postoperative right working occlusion.

Figure 16. View of the patient's postoperative left working occlusion.

Figure 17. View of the patient's postoperative maxillary occlusal pattern.

Figure 18. View of the patient's right crossover occlusion.

Figure 19. View of the patient's left crossover occlusion.

Figure 20. The final restorations corrected the aesthetic problem and addressed the functional concerns regarding the occlusion and anterior guidance.

lary midline that was the result of the hereditary absence of tooth No. 12. In addition, tooth No. 22 was in a facial position, precipitating a movement to the left of all of her maxillary and mandibular incisors. Instead of having all embrasures perpendicular to the occlusal plane, they were all slanted to the patient's left side. The irregular positioning of these incisors led to incisal fractures of these teeth (Figure 12). Her chief complaint was the appearance of her mandibular teeth. Correcting these problems would involve improving anterior guidance.

Proposed Treatment

Orthodontic treatment was not accepted by the patient. Therefore, the decision was made to utilize 5 porcelain laminate veneers for the mandibular dentition. A cutback technique was to be used that would place porcelain with low wear characteristics on the incisal edges to minimize wear of the maxillary anterior teeth (Figure 13).

Treatment Planning

In terms of equilibration of the occlusion, several objectives directed the treatment plan. First, equal and simultaneous contacts on all teeth needed to be established. Secondly, the restorations needed to provide adequate canine guidance in lateral movement with no interferences on the working and nonworking sides. Additionally, there could be no functional contacts other than centric holding contacts on the lateral incisors. The lateral incisors have the shortest roots of all teeth and can least tolerate lateral forces without breaking or wearing.

The proposed restorations would have to provide a sharp facio-incisal line angle on all 4 mandibular incisors in order to engage the lingual aspect of the maxillary anterior teeth at the centric holding stops (Figure 14). Further, a slightly rounded lingual incisal line angle would need to be created on the mandibular incisors so that these teeth would move smoothly into maximum protrusion.

Ideally, when treatment was completed, if the patient moved into right or left lateral working occlusion (Figures 15 and 16), the canines would bear the entire occlusal load. In addition, when the tip of the maxillary canines moved onto the rounded lingual aspect of the mandibular canines and into the crossover position, the transition should be smooth (Figures 17 through 19). The occlusal load should shift to the incisal edges of the maxillary central incisors, with no force applied on the maxillary lateral incisors.

This approach maximizes aesthetics and meets functional demands. As noted, the lateral incisors have the shortest root system of all teeth, and can least support horizontal forces.

Pretreatment Consultation With the Laboratory Technician

Pretreatment planning involved the use of mounted, equilibrated models, and the models were modified to simulate the desired end result. This information was forwarded to the laboratory, enabling the technician to fabricate restorations specifically to the patient's and clinician's specifications.

Prior to tooth preparation, a meeting with the laboratory technician was held to discuss what would be accomplished aesthetically and functionally. The focus was on repairing the chipped incisal edges and rearranging the embrasures so they were perpendicular to the occlusal plane. No changes in tooth shade were planned. Functional changes involved building the patient's left canine guidance, as well as establishing the dynamics of pitch, bevel, and crossover. Pitch is the angle of the flat portion of the maxillary and mandibular incisal edges as they rest upon each other in an end-to-end position. Bevel is the sharp, facio-incisal edge of the mandibular incisors. The concept of crossover relates to the smooth transfer of occlusal support from canines to incisors.

Authentic porcelain (Microstar Corporation) was selected for the veneer restorations. This choice was based on its low wear characteristics and biocompatibility. Indicated for metal-free pressed ceramic veneers, crowns, inlays, and onlays,

Final impressions were taken

this material consistently and predictably exhibits excellent aesthetic results. Very accurate fit can be achieved with this material. Furthermore, this material requires minimal tooth preparation due to its strength in thin applications.

The lateral incisors have the shortest root system of all teeth, and can least support horizontal forces.

Clinical Protocol

The patient was anesthetized using bilateral mandibular inferior alveolar blocks, with limited infiltration at the mental foramen. Septocaine 1:100,000 epinephrine (Septodont Inc) was used and provided profound anesthesia. Tooth No. 22 was first prepared into arch alignment. A 2-depth cut technique was utilized with 0.5-mm (No. 34 021, Brasseler USA) and 0.3-mm (No. 834 016, Brasseler USA) burs. After each depth cut, tooth structure was removed with a round-ended diamond (No. 6856 016, Brasseler USA). A depth of 0.88 mm was achieved.

The incisal edges were reduced with depth cuts of 1 mm using a green-striped, round-ended diamond bur (No. 6856 016 Brasseler USA) with a 1-mm diameter tip. The patient was asked to stand in order to check that the incisal edges were symmetrical and parallel to the floor.

Next, all embrasures were opened to the lingual. This allowed the technician to correct the canted appearance of the teeth. Again, a green-striped, round-ended diamond (No. 6856 016, Brasseler USA) was used for this reduction.

All sharp edges or contours, as well as the margins, were polished with a diamond (No. 0875 009, Brasseler USA). Finally, the coronal third of each preparation was polished to a high shine using a 1-step polishing point (One-Step, Shofu Dental Corporation).

Impression, Models, and Temporization

Final impressions were taken using a polyvinylsiloxane impression material (Aquasil Monophase, DENTSPLY). An occlusal record was also taken using bite registration material (Futar D, Roydent Dental Products).

A clear stent was made over the corrected models utilizing the Omnivac V vacuum adapter (Omni Dental Corp). The original model of the lower arch was prepared, and the composite "re-enamel" was utilized to sculpt the final shape and position of the teeth. This mock-up was used to demonstrate the anticipated result to the patient as well as to fabricate the provisional restorations.

The provisional restorations were created using Flex-Span (Pentron). After contouring and polishing, these restorations were filled

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with a bonding agent (Opti-Bond, Kerr) and light-cured for retention. However, prior to curing, all excess agent was air dried away from the gingiva. The completed provisional restorations were tried-in using only water to verify aesthetic considerations, and following patient approval, were bonded into place using Calibra cement (DENTSPLY).

Excess cement was removed, and all margins were polished. Finishing and polishing protocol included the use of a Brasseler No. 30 grit diamond (379-31-023; 135F-31-014); Brasseler No. 15 grit diamond (135EF-31-014; 379EF-31-023); Brasseler No. 30 bladed finishing bur (H379UF-023; H135UF-014); Shofu no-strip polishing point; Shofu yellow-stripe polishing point; and Shofu white-strip polishing point. To open the contacts between the restorations, a CeriSaw (Kit No. 031336500, Den-Mat); a red-stripe diamond strip (GC America, Inc); and the complete Epitex strip series (ie, blue, green, tan, gray; GC America, Inc) were used.

The direction of forces applied to restoration of the anterior teeth can determine success or failure of treatment.

Final Restorations

The final restorations corrected the aesthetic problem of broken incisal edges and cant and helped address the functional concerns regarding occlusion and anterior guidance. Further, the final restorations were aesthetically pleasing to the patient (Figure 20). The protocol as described achieved the objective of eliminating the aesthetic and functional deficit associated with the mandibular arch. Due to the patient's desire to complete treatment in phases, the maxillary anterior teeth would be treated in the future.

CONCLUSION

The direction of forces applied to restoration of the anterior teeth can determine success or failure of treatment. The ability to incorporate proper occlusal forces is essential for success. Knowing what constitutes a minimally stressed occlusion, as well as how this can be accomplished, will help ensure the functional predictability of aesthetic reconstructions.

In summary, creating proper anterior guidance and proper occlusal morphology patterns requires the clinician to:

- Coordinate centric relation stops on all anterior teeth.
- According to Dawson, "long centric" can be defined as freedom to close the mandible either into centric relation or slightly anterior to it without varying the ver-

The ability to incorporate proper occlusal forces is essential for success.

tical dimension of occlusion.[8] Establish long centric by slightly reducing the gingival aspect of the centric holding contact.

- Establish group function in straight protrusion.
- Establish ideal anterior stress distribution in lateral excursion through either group function or canine guidance.✦

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Acknowledgement

The restorations featured in this article were fabricated by John Wilson of Wilson Dental Arts in Raleigh, NC.

Dr. Wynne maintains a private practice in Raleigh, NC, emphasizing aesthetic and restorative dentistry. He graduated from the University of North Carolina School of Dentistry, Chapel Hill, in 1971, and has since completed 6 continuums at The Pankey Institute as well as the aesthetic course, and is a teaching associate. Dr. Wynne recently achieved the status of Pankey Scholar. A member of the American Academy of Cosmetic Dentistry and a longtime member of the American Academy of Dental Practice Administration, he has lectured and published on aesthetic dentistry, occlusion, and eating disorders. He can be reached at (919) 851-3716.

Continuing Education
Test No. 52.1

To submit Continuing Education answers, use the answer sheet on page 110. On the answer sheet, identify the article (this one is Test 52.1), place an X in the box corresponding to the answer you believe is correct, detach the answer sheet from the magazine, and mail to *Dentistry Today* Department of Continuing Education.

The following 8 questions were derived from the article *Considerations for Establishing and Maintaining Proper Occlusion in the Aesthetic Zone* by William P.D. Wynne, DDS, on pages 112 through 119.

Learning Objectives

After reading this article, the individual will learn:

- To design a minimally stressed occlusal pattern for anterior teeth.
- To improve longevity of anterior restorations by properly directing occlusal forces.

1 What is the purpose of anterior guidance?
a. Protection of anterior teeth from excessive lateral forces.
b. Allows the posterior teeth to erupt into proper vertical dimension.
c. Protection of the posterior teeth from lateral forces.
d. The short root of the canine makes them less desirable to withstand lateral forces.

2 In the proper canine guided occlusion:
a. there are 2 centric stops on each central and lateral incisor as well as on the canine.
b. the forces on the posterior teeth are directed horizontally.
c. the forces on the anterior teeth are only vertical in nature.
d. there are 2 centric stops on each of the central incisors, and one stop on each lateral incisor and canine.

3 The end-to-end position is indeed a rest position because:
a. it allows the maxillary central incisors to function with the 4 mandibular incisors in a variety of planes.
b. the pitch of the maxillary and mandibular teeth are complementary, allowing the maxillary central incisors and 4 mandibular incisors to function in the same plane.
c. the pitch of the molars is vital to muscular release.
d. premolar bevel complements incisal pitch.

4 Crossover position:
a. occurs when the molars contact each other in lateral excursion.
b. occurs in lateral excursion when the molars move into contact after the incisors and canines have completed functional movements.
c. is the portion of the occlusal path after the canines have contributed their support and the incisors then assume support.
d. is established to place horizontal forces on posterior teeth.

5 In terms of equilibration of the occlusion, the following objectives directed the treatment plan in this article:
a. establish equal and simultaneous contacts on teeth.
b. establish crossover on the patient's right side only.
c. increase horizontal force to posterior teeth.
d. have the lateral incisors more involved in lateral guidance.

6 Pitch:
a. relates to the plane of occlusion and curve of Wilson.
b. relates to the speed of disclusion of the posterior teeth.
c. is a system of persuading the patient to accept treatment.
d. is the angle of the flat portion of the maxillary and mandibular incisal edges as they rest upon each other in an end-to-end position.

7 Bevel:
a. is another measurement of the curve of Spee.
b. is the sharp facio-incisal edge of mandibular incisors.
c. is a measure of the steepness of molar cusp tips.
d. is a measure of the steepness of premolar cusp tips.

8 Creating proper anterior guidance and proper occlusal morphology patterns requires the clinician to:
a. coordinate centric relation stops on selected teeth.
b. establish short centric by slightly reducing the gingival aspect of the centric holding cusp.
c. establish canine-guided function in straight protrusion.
d. establish ideal anterior stress distribution in lateral excursion through either group function or canine guidance.

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