



Semnan UNIVERSITY
OF
MEDICAL SCIENCES

Role of Occlusion and TMD in Periodontal Disease Management

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Pathogenesis

- Destructive events can be episodic and are site specific.
- Periodontal deterioration that occurs rapidly or that is excessive for a person's age should prompt the clinician to investigate all variables that can amplify the patient's periodontitis. If a local factor, such as an occlusal relationship, can influence the course of the disease, its analysis must be as precise as any other aspect of the periodontal examination.

Evidence-Based Decision Making

- The role of occlusal trauma and its possible influence on the progression of periodontitis is tooth specific.
- In 2001, Nunn and Harrell reported that trauma from occlusion amplified the loss of attachment. They also reported that eliminating occlusal interferences had a positive influence on the outcome of treatment when trauma from occlusion was found to be a contributing local factor.
- The positive influence of occlusal adjustment on the outcome of surgical and nonsurgical periodontal therapies was also reported by Burgett.
- KEY FACT:

Occlusal trauma can amplify (not cause) localized loss of attachment from inflammatory bone damage.

- In two studies using a periodontitis-induced rat model, occlusal trauma resulted in readily identifiable changes in the periodontal ligament of the experimental group compared with the controls. Greater numbers of osteoclasts, perhaps related to increased receptor activator of nuclear factor- κ B ligand (RANKL) expression, supported the observation of greater alveolar bone loss in the inflammation plus trauma group.
- No or minimal occlusal contact on a tooth results in disuse atrophy of the periodontium, which can result in instability of that tooth. Harmonious occlusal force on a tooth stimulates the physiologic arrangement of the periodontal attachment fibers and osseous architecture and encourages stability. Forces that exceed the tolerance of the periodontium result in resorption of the bone and disruption of the attachment.
- In the healthy person, the periodontium around teeth that are subject to excessive occlusal force experiences adaptation and repair or remodeling with no loss of attachment, which often occurs with orthodontics.

Effect of Occlusal Force on the Periodontium

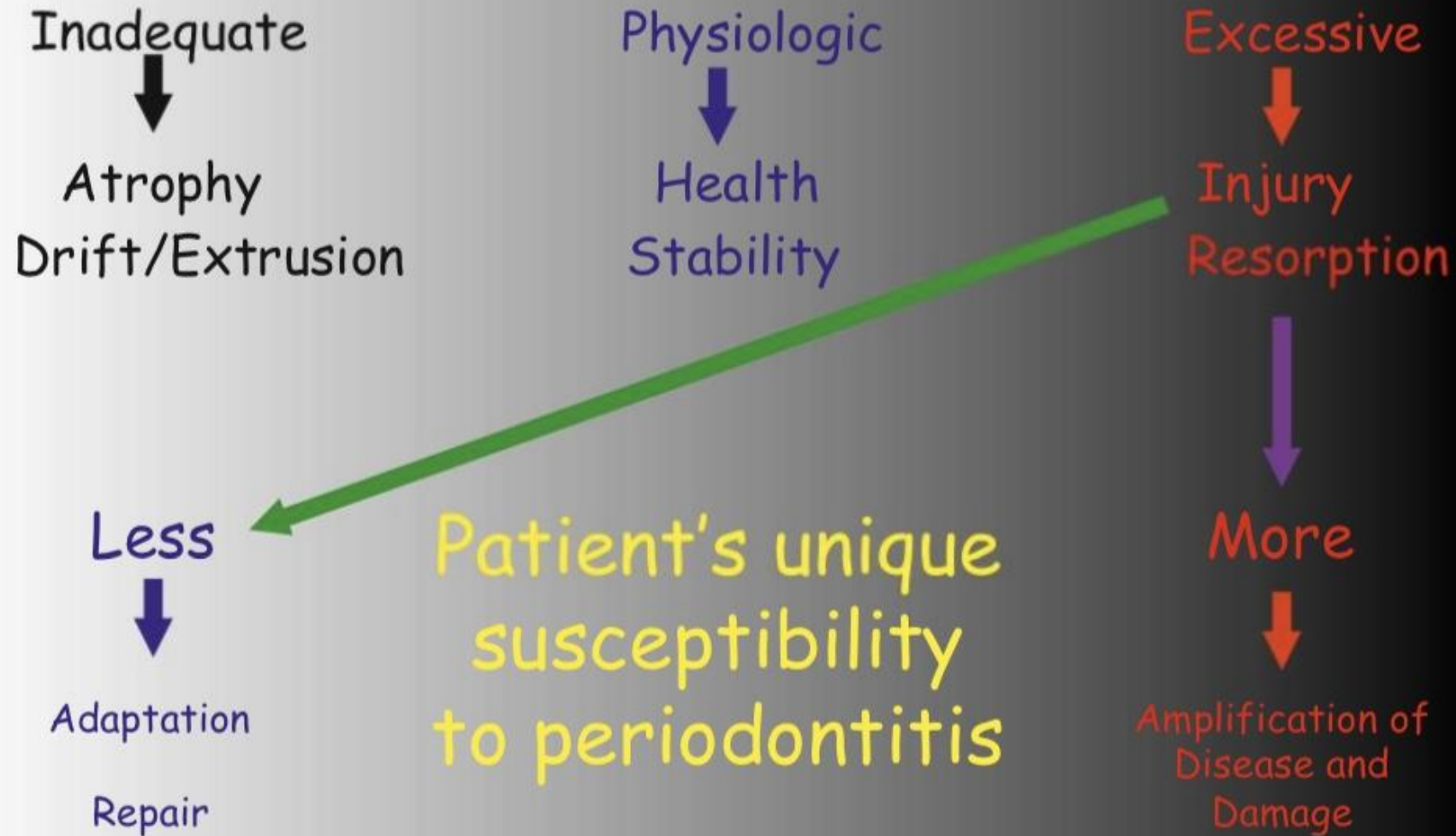


Fig. 35.1 The degree of occlusal force is depicted as a spectrum of white to black, representing none to excessive force.

Terminology

- **Centric relation:** Position of the mandible when both condyle-disc assemblies are in their most superior positions in their respective glenoid fossae and against the slope of the articular eminences of each respective temporal bone.
- **Disclusion:** Separation of certain teeth caused by the guidance provided by other teeth during an excursion. When anterior guidance provides separation of posterior teeth during an excursion, posterior disclusion is achieved.
- **Excursive movement:** Any movement of the mandible away from maximum intercuspation.
- **Guidance:** The pattern of opposing tooth contact during excursive movements of the mandible.
- **Initial contact in centric relation:** The first occlusal contact in the centric relation closure arc.

- **Interference:** Any occlusal contact in the centric relation closure arc or in any excursion that prevents the remaining occlusal surfaces from achieving stable contact or functioning harmoniously or that encourages masticatory system disharmony; also called an occlusal discrepancy.
- **Lateral excursion:** Movement of the mandible laterally to the right or to left from maximal intercuspation.
- **Maximal intercuspation:** Position of the mandible when there is maximal interdigitation and occlusal contact between the maxillary and mandibular teeth; also called centric occlusion and intercuspation position.
- **Nonworking side:** The side of either arch that corresponds with the side of the mandible moving toward the midline during a lateral excursion; also called the balancing side.
- **Protrusion:** Movement of the mandible anteriorly from maximal intercuspation.

- **Retrusion:** Movement of the mandible posteriorly relative to a more anterior position.
- **Working side:** The side of either dental arch that corresponds with the side of the mandible moving away from the midline during a lateral excursion.

Occlusal Function and Dysfunction

- Trauma from occlusion is determined by whether the composite of all occlusal forces on a specific tooth exceeds the tolerance or adaptability of its periodontium.
- Centric relation is a term used to describe the position of both condyles when they are fully seated in the fossae of their respective temporomandibular joints (TMJs).
- Rotation of the mandible around an axis through both condyles is called the centric relation closure arc. This is strictly a skeletal relationship until tooth contact occurs.

- Maximal intercuspatation occurs when opposing teeth make contact, with optimal interdigitation, at the most stable end point of mandibular closure.
- Stability is enhanced by the simultaneous bilateral contact of multiple posterior teeth with occlusal forces in the long axis of most posterior teeth.
- If the initial tooth contact in the centric relation arc of closure occurs simultaneously with maximal intercuspatation, the teeth do not displace the condyles.
- Conversely, if the teeth are firm and any contact occurs before maximal intercuspatation, incline relationships of opposing occlusal surfaces guide the mandible into intercuspal position, thereby requiring one or both condyles to become dislocated from their fossa.
- If the teeth are mobile and contact first in the centric relation closure arc, then they may move away from opposing teeth rather than cause condylar displacement.

- Cusp-fossa or cusp–marginal ridge relationships of the posterior teeth provide resistance to vertical loading and functional stability for the patient's dentition.
- When occlusal forces load teeth in their long axis, the periodontium is the most resistant and supportive. The anterior teeth can be stable with little occlusal loading in centric occlusion if they are favorably influenced by the oral musculature. If the anterior teeth are in contact in maximal intercuspation, they are coupled.
- Movement of the mandible from centric occlusion is called an excursion. Movement forward is called a protrusive excursion, and movement to either side is called a lateral excursion. If the mandible can move posteriorly, it is called retrusion.
- There is evidence that the contact of posterior teeth in excursions can overload those teeth, which results in negative dental, periodontal, muscular, and TMJ consequences.

- The ideal relationship may be a light coupling of the anterior teeth in centric occlusion with immediate separation (i.e., disclusion) of all posterior teeth in all excursions.
- During a lateral excursion, posterior teeth that make contact on the same side as the direction of mandibular movement are described as having a working contact. Posterior teeth that make contact on the side opposite the direction of the lateral excursion are described as having a nonworking contact.
- Although non- working contacts are classically associated with negative consequences, the analysis of working contacts and the function of anterior teeth are critically important.
- Inflammation disrupts the integrity of the attachment apparatus, which results in less resistance to force from opposing teeth. When bone loss has occurred, less root surface area is supported, and there are fewer sensory fibers in the periodontal ligament, which limits the protective muscle modulation of the occlusal forces.

Parafunction

- Bruxism can cause occlusal forces on teeth that are susceptible to periodontitis to be increased in intensity or frequency, thereby magnifying the potential amplification of damage.
- Daytime or awake occlusal parafunction is commonly limited to clenching the teeth during incidents that require a person's focused effort or mental concentration.
- Nighttime or sleep bruxing of the teeth can take the form of grinding the teeth during various excursions or clenching the teeth. Sleep bruxism is probably an extension of the rhythmic masticatory muscle activity that is also observed in nonbruxers. Bruxing is associated with the greater frequency and persistence of TMJ dysfunction, orofacial pain, and possibly periodontal attachment loss.

- They found that selective serotonin reuptake inhibitors such as Prozac encouraged bruxism.
- sleep-disordered breathing can influence or be associated with inflammatory diseases such as periodontitis. A strong relationship between obstructive sleep apnea and sleep bruxism has now been firmly established.

Clinical Examination

Temporomandibular Disorders Screening and Evaluation

- The patient's range of motion is observed, maximal opening and the lateral and protrusive excursions are measured, and any deviation from the midline during opening and closing is defined. Light finger pressure applied over each TMJ can detect deflection of the tissue while the patient opens and closes the mouth; deflection suggests condyle-disc discoordination.
- Tenderness on palpation can indicate TMJ capsulitis.
- Listening to the joint with a stethoscope or a Doppler instrument during opening and closing can detect sounds that are consistent with uncoordinated condyle-disc relationships, arthritic changes, and other diagnostic sounds.¹⁶
- Palpation of the muscles of mastication and the related head and neck musculature can reveal muscle tension or spasm related to compensation for occlusal or TMJ disharmonies.

BOX 35.1 Temporomandibular Disorder Screening Evaluation

1. Maximal interincisal opening (range, 40–50 mm)
2. Opening or closing pathway
3. Range of lateral and protrusive excursions (7–9 mm)
4. Auscultation for temporomandibular joint sounds
5. Palpation for temporomandibular joint tenderness or tissue displacement
6. Palpation for muscle tenderness
7. Load testing of the patient's temporomandibular joints

Testing for the Mobility of Teeth

- Two basic methods are used to assess the firmness or looseness of a tooth. Classically, a dental instrument is used to exert pressure in the facial or lingual direction, and the dentist places his or her finger on the opposite side of the tooth to feel and see movement if it occurs. Recording a numeric value (range, 0 to 3) for the degree of mobility allows the clinician to track changes that may occur in response to therapy.
- The other method is to test for the movement of teeth that are subject to pressure generated by the patient. Fremitus, vibration, or micromovement of a tooth can be felt when patients tap their teeth together.
- When the patient mimics clenching the teeth and then attempts to move the mandible in excursions, tooth movement can be observed.
- If the mobility of the teeth exceeds what is expected on the basis of the loss of support or the level of inflammation observed, trauma from occlusion is included in the diagnosis.



Fig. 35.2 (A) Tactile and visual testing for mobility is done with a dental instrument by the dentist. (B) Tactile and visual testing for mobility is done with the patient clenching and while beginning right lateral excursion by the dentist. (C) The patient feels movement of her tooth when lateral excursion is attempted while the teeth are clenched.

Centric Relation Assessment

- Bimanual manipulation of the mandible in the axis of rotation of the condyles in their respective glenoid fossae has become a standard method of assessing centric relation. and it involves gentle guidance rather than the forced positioning of the mandible. This technique is essential for load testing of the TMJs, and it is effective for generating centric relation records for mounting diagnostic casts.
- If hinging is uncomfortable or not repeatable, muscle deprogramming may be beneficial. Other methods for guiding the condyles toward a seated position (e.g., leaf gauges, anterior bite stops) can be effective.
- Asking the patient to identify the first tooth to touch in the centric relation arc of closure may indicate that interferences to closure into maximal intercuspation exist.



Fig. 35.3 Bimanual manipulation is used to hinge the mandible in centric relation and to load test the temporomandibular joints.

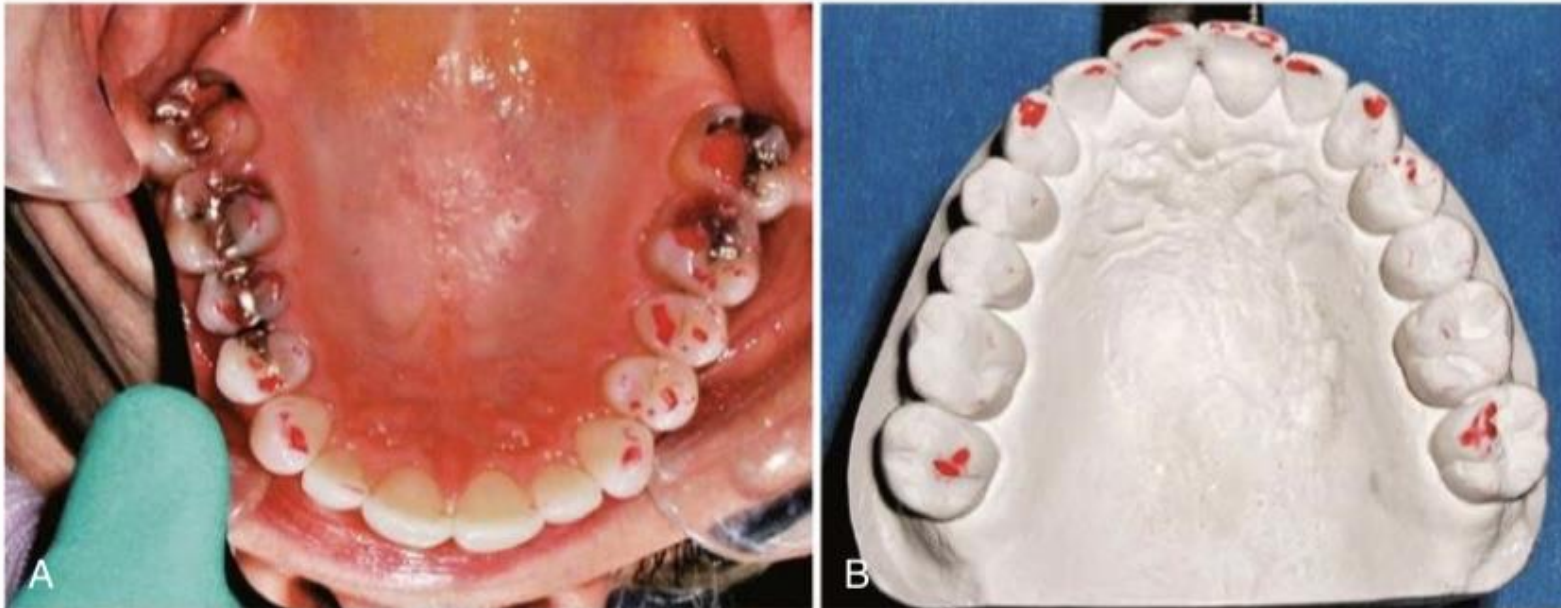


Fig. 35.4 (A) Teeth are marked clinically in maximal intercuspation and in excursions while clenching. (B) Teeth are marked in centric relation and maximal intercuspation on a diagnostic cast mounted in centric relation. Marks only on the second molars indicate that they were mobile and that they moved to permit the contact of other teeth.

Evaluation of Excursions

- Marking the teeth in all excursions reveals the pathways of contact of opposing occlusal or incisal surfaces during function, and it may identify interferences to harmonious function. Movement of any teeth during marking may lessen the intensity of the marks and the assessed severity of the forces experienced by the affected teeth.

Articulated Diagnostic Casts

- Study of the accurately mounted diagnostic casts can reveal occlusal discrepancies between initial contact in the centric relation closure arc and maximal intercuspation and occlusal disharmonies in excursions.
- Mobile teeth may produce a mark on a solid model but little or no mark in that patient's mouth during clinical assessment.

Occlusal Therapy

- Effective nonsurgical therapy usually reduces inflammation within the periodontium and results in some healing of attachment, which often results in mobile teeth becoming more stable. If the clinician concludes that inflammation has been optimally controlled and that occlusal forces on individual teeth still exceed the tolerance of the periodontium, the basis for intervention is established.
- The harmonious function of both TMJs and their associated muscles is required for occlusal stability. When there is sufficient evidence of excessive occlusal forces on the patient's teeth or when masticatory system disharmony exists and the patient desires a more stable occlusion, an occlusal appliance is prescribed.
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Occlusal Appliance Therapy

- The bilateral simultaneous contact of all opposing posterior teeth in centric relation, shallow anterior guidance, and the immediate disclusion of all posterior teeth in every excursion are essential elements of maxillary and mandibular occlusal appliances.
- Teeth that are opposing an appliance should be loaded as close as possible to their long axis.
- Maxillary appliances engage a portion of the hard palate, which provides substantial bracing of teeth and resistance to vertical and lateral forces. A horseshoe-shaped maxillary appliance relies on other, possibly compromised teeth to attempt to protect the most mobile teeth.
- Soft or partial coverage appliances are contraindicated for long-term protection and stabilization.

- Occlusal appliances are not expected to cure bruxism, but they are often prescribed for patients with habitual parafunction as a compensating or protective intervention to limit masticatory system disharmony, damage to the teeth, and overstressing of implants.

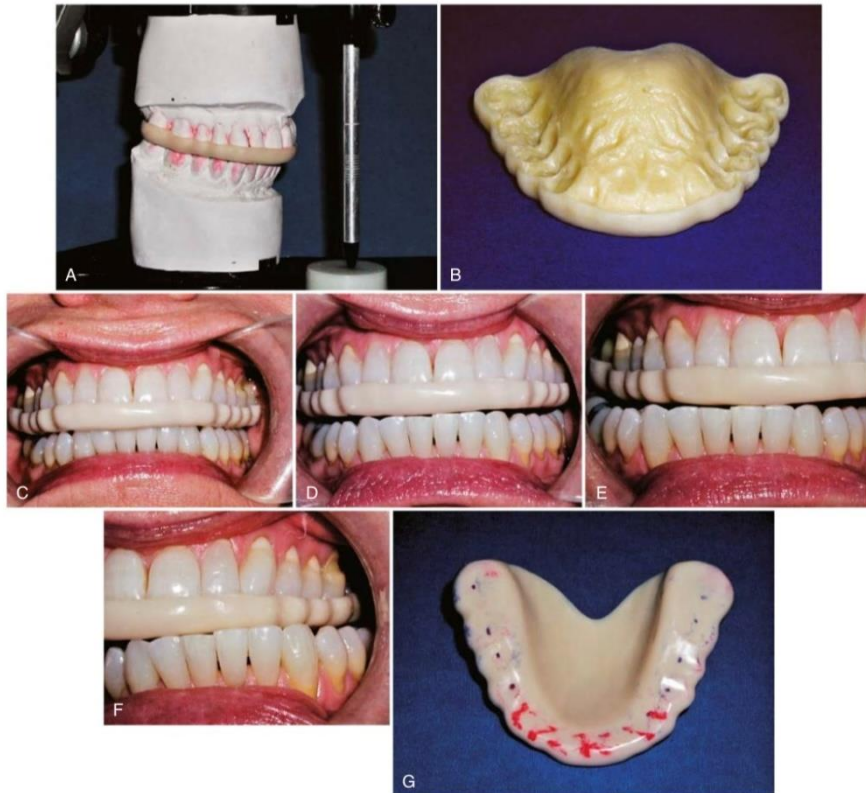


Fig. 35.5 (A) An occlusal appliance is fabricated on accurately mounted diagnostic casts. (B) The entire dental and palatal surface has been carefully relined to promote an optimal stabilizing influence on mobile teeth. (C) There is bilateral, simultaneous contact of the cusps and all posterior teeth in centric relation, fabricated to enhance axial loading of opposing mandibular teeth. (D) There is smooth, relatively flat anterior guidance with immediate and sustained discusion of all posterior teeth in protrusion. (E) There is smooth, relatively flat anterior guidance with immediate and sustained discusion of all posterior teeth in right lateral excursions. (F) There is extreme left lateral excursion with smooth, harmonious transitions across the anterior teeth to maintain the discusion of all posterior teeth. (G) Marks created by the opposing dentition demonstrate bilateral, simultaneous contact in centric relation and the immediate discusion of the opposing posterior teeth in all excursions.



Fig. 35.6 A mandibular occlusal appliance is fabricated after surgery to provide a stabilizing influence for the incisors in particular and to demonstrate occlusal attributes similar to those of the maxillary appliance.

Occlusal Adjustment

- As teeth tighten from consistent use of the appliance, occlusal interferences may become more evident, and greater discrepancy between the initial dental contact and maximal intercuspation may be observed.
- occlusal adjustment or selective reshaping of the occluding surfaces of the teeth can reduce the magnitude of occlusal interferences or direct the forces to be more compatible with the long axes of the affected teeth.
- Scheduling patients so that they leave their appliances on the teeth in each arch overnight and in place until they are seated in the dental chair allows assessment of their teeth at maximal firmness, when interferences are most readily identifiable.
- Other methods that can be used to alter occlusal relationships include orthodontics and restorative dentistry. Provisional restoration of teeth is another method of improving occlusal contacts and stability, and it often simplifies the process of occlusal adjustment and final restoration.

Occlusal Stability for Restorative Dentistry

- A stable occlusion is considered a prerequisite for any restorative therapy.
- Implants to replace the teeth of a partially dentate patient add to the occlusal considerations. Osseointegration of implants eliminates micromovement, which can allow teeth to accommodate occlusal forces.
- The extent and timing of occlusal loading and the guidance requirement for each tooth and for each implant must be carefully harmonized. This is especially critical if any of the teeth are mobile or the patient bruxes to a significant degree. If bruxism is suspected or the functional forces are considered to be excessive, the occlusal appliance as described may be a valuable application.

BOX 35.2 Requirements for Occlusal Stability

1. Forces on an individual tooth that do not exceed the support and resistance of the tooth's periodontium and that are vertically oriented to the long axis of each tooth as much as possible
2. Even and simultaneous contact of all posterior teeth in the centric relation closure or in maximal intercuspation, with minimal difference between the two
3. Little or no contact of the anterior teeth in centric occlusion, although such contact is readily available to provide guidance in excursion and to produce posterior disclusion
4. Harmonious excursive movement of the mandible within the patient's envelope of function and with complete absence of occlusal interference

Conclusions

- The sequence of occlusal treatment begins with antiinflammatory therapy and progresses through reversible appliance therapy before any irreversible options are considered.

Good luck