

Occlusal Trauma in Periodontium - A Review

Dr. Noufa. M¹, Dr. P. Bhuvaneshwari², Dr. Vanitha Mullan³

¹Postgraduate Student, Department of Periodontics and Oral Implantology, Tamilnadu Government Dental College, Chennai
(Corresponding Author)

²Professor, Department of Periodontics and Oral Implantology, Tamilnadu Government Dental College, Chennai

³Postgraduate Student, Department of Periodontics and Oral Implantology, Tamilnadu Government Dental College, Chennai

1. Introduction

Occlusion and its relationship to periodontal disease have been and remains an area of considerable controversy. Traumatic occlusion, a pathological state of occlusion, has been theorized that the situation could lead to migration of epithelial cuff, localized bone loss, and ultimately the result is pocket deepening. Many researches and studies have aimed to disprove this theory since periodontitis is believed of bacterial etiology.

OCCLUSAL TRAUMA: An injury to the attachment apparatus as a result of excessive occlusal force. Occlusal trauma is the tissue injury, and not the occlusal force. Occlusal trauma can be divided into 3 general categories:

- 1) *Primary Occlusal Trauma:* Injury resulting from excessive occlusal forces applied to a tooth or teeth with normal support. Examples include high restorations, bruxism, drifting or extrusion into edentulous spaces, and orthodontic movement.
- 2) *Secondary Occlusal Trauma:* Injury resulting from normal occlusal forces applied to a tooth or teeth with inadequate support. Teeth with a reduced adaptive capacity and compromised periodontium may then migrate when subjected to certain occlusal forces. Factors such as the frequency, duration, and velocity of those occlusal forces, not just their magnitude, may be of greater significance in the development of tooth hypermobility. This mobility is a common clinical sign of occlusal trauma.
- 3) *Combined Occlusal Trauma:* Injury from an excessive occlusal force on a diseased periodontium. In this case, there is gingival inflammation, some pocket formation, and the excessive occlusal forces are generally from parafunctional movements.

TRAUMATOGENIC OCCLUSION: Any occlusion that produces forces that cause an injury to the attachment apparatus.

Occlusal Traumatism: The overall process by which a traumatogenic occlusion produces injury in the periodontal attachment apparatus.

2. Background

As far back as 100 years ago, it was felt that occlusion played a significant part in periodontal disease and the formation of vertical clefts.

Glickman proposed the *Theory of Codestruction* to explain the relationship between occlusion and periodontal disease. He described two regions in the periodontium:

- The *zone of irritation* (marginal and interdental gingiva and gingival and transeptal fibers)
- The *zone of codestruction* (periodontal ligament, alveolar bone, cementum, transeptal and alveolar crest fibers).

He felt that plaque induced gingival inflammation was confined to the zone of irritation. Occlusal forces or traumatogenic occlusion effected the zone of codestruction but did not cause gingival inflammation. However, occlusal trauma together with plaque induced inflammation acted as codestructive forces resulting in an alteration of the normal pathway of inflammation and the formation of angular bony defects and infrabony pockets.

In contrast to the codestructive theory, **Waerhaug** believed there was no proof that occlusal trauma caused or acted as a cofactor in the formation of angular defects. He believed that infrabony pockets were associated with the advancing "plaque front" or apical growth of subgingival plaque and the formation of either horizontal or angular bone defects were dependent on the width of the interproximal bone. Teeth with narrow interproximal bone develop horizontal defects while teeth with wide interproximal bone were more likely to develop angular or vertical defects.

Clinical Features

A positive diagnosis of occlusal traumatism can be made if some of the signs and symptoms of an injury can be located in some part of the masticatory system.

The following represent clinical features of such an injury, but are not pathognomonic for the condition:

- 1) Tooth mobility: Increasing displacement may be of greater concern since a stable pattern of mobility may indicate adaptation.
- 2) Tooth migration.
- 3) Tooth pain or discomfort on chewing or percussion.
- 4) Tenderness of the muscles of mastication or other signs or symptoms of temporomandibular dysfunction.
- 5) Presence of wear facets beyond expected levels for the patient's age and diet consistency.
- 6) Chipped enamel or crown/root fractures.
- 7) Fremitus.

These clinical signs and symptoms may be indicative of other pathoses. Therefore, differential diagnoses may be established. Use of supplementary diagnostic procedures

may be helpful; e. g., radiographs, pulp vitality tests and evaluation of parafunctional habits.

Radiographic Features:

- 1) Widening of the periodontal ligament space,
- 2) Disruption of the lamina dura,
- 3) Radiolucencies in the furcation or at the apex of a tooth that is vital,
- 4) Root resorption.

Just as with mobility, stable radiographic findings may indicate adaptation.

Therapeutic Goals and Treatment Considerations:

A goal of periodontal therapy in the treatment of occlusal traumatism should be to maintain the periodontium in comfort and function.

In order to achieve this goal a number of treatment considerations must be considered including one or more of the following:

- 1) Occlusal adjustment
- 2) Establish or maintain a stable, reproducible intercuspal position. If the existing relationship is altered through treatment, the new relationship should be physiologically acceptable to the patient.
- 3) Provide freedom of movement to and from the intercuspal position, including movement in all directions regardless of the initial point of contact.
- 4) Provide for efficient masticatory function.
- 5) Develop a comfortable occlusion.
- 6) Establish an occlusion with acceptable phonation and esthetics.
- 7) Eliminate or modify parafunctional habits.
- 8) Elimination or reduction of tooth mobility. Temporary, provisional or long - term stabilization of mobile teeth with removable or fixed appliances
- 9) Orthodontic tooth movement
- 10) Occlusal reconstruction
- 11) Extraction of selected teeth

Occlusal Adjustment:

Occlusal adjustment or selective grinding is defined as reshaping the occluding surfaces of teeth by grinding to create harmonious contact relationships between the upper and lower teeth. Just as controversy surrounds the subject of trauma from occlusion and its role in the progression of periodontal disease, the same is also true regarding the subject of occlusal adjustment.

The 1989 World Workshop in Periodontics listed the following indications and contraindications for occlusal adjustment.

Indications for Occlusal Adjustment:

- 1) To reduce traumatic forces to teeth that exhibit:
 - Increasing mobility or fremitus to encourage repair within the periodontal attachment apparatus.
 - Discomfort during occlusal contact or function.
- 2) To achieve functional relationships and masticatory efficiency in conjunction with restorative treatment, orthodontic, orthognathic surgery or jaw trauma when indicated.

- 3) As adjunctive therapy that may reduce the damage from parafunctional habits.
- 4) To reshape teeth contributing to soft tissue injury.
- 5) To adjust marginal ridge relationships and cusps that are contributing to food impaction.

Contraindications for Occlusal Adjustment:

- 1) Occlusal adjustment without careful pretreatment study, documentation, and patient education.
- 2) Prophylactic adjustment without evidence of the signs and symptoms of occlusal trauma.
- 3) As the primary treatment of microbial - induced inflammatory periodontal disease.
- 4) Treatment of bruxism based on a patient history without evidence of damage, pathosis, or pain.
- 5) When the emotional state of the patient precludes a satisfactory result.
- 6) Instances of severe extrusion, mobility or malpositioning of teeth that would not respond to occlusal adjustment alone.

A number of studies have reported that the presence of occlusal discrepancies is not associated with increased destruction caused by periodontal disease.

Burgett found that patients who received occlusal adjustment as a part of periodontal treatment had a statistically greater gain in attachment level than those who did not receive an occlusal adjustment. While these results may have been statistically significant, these small differences did not have clinical significance.

The 1996 World Workshop in Periodontics found little recent research on the role of occlusion in periodontal disease. It also found no prospective controlled studies on the role of occlusion on untreated periodontal disease and that ethical considerations make it unacceptable to perform such studies.

Recently, a pair of human studies found that teeth with initial occlusal discrepancies had significantly deeper initial probing depths, greater mobility and a worse prognosis than teeth without initial occlusal discrepancies. These studies also found that treatment of occlusal discrepancies significantly reduced the progression of periodontal disease and can be an important factor in the overall treatment of periodontal disease.

It is generally accepted that occlusal adjustment directed solely at establishing an ideal conceptualized pattern is contraindicated. Rather, it should only be performed when the objective is to facilitate treatment or intercept actively destructive forces.

When occlusal therapy is planned as part of periodontal treatment, it is usually deferred until initial therapy aimed at minimizing inflammation throughout the periodontium has been completed. This is based upon the fact that inflammation alone can contribute significantly to a tooth's mobility.

Splinting:

The following are indications and contraindications for splinting as listed in the 1989 World Workshop in Periodontics.

Indications for Splinting:

- 1) Stabilize teeth with increasing mobility that have not responded to occlusal adjustment and periodontal treatment.
- 2) Stabilize teeth with advanced mobility that have not responded to occlusal adjustment and treatment when there is interference with normal function and patient comfort.
- 3) Facilitate treatment of extremely mobile teeth by splinting them prior to periodontal instrumentation and occlusal adjustment procedures.
- 4) Prevent tipping or drifting of teeth and extrusion of unopposed teeth.
- 5) Stabilize teeth, when indicated, following orthodontic movement.
- 6) Create adequate occlusal stability when replacing missing teeth.
- 7) Splint teeth so that a root can be removed and the crown retained in its place.
- 8) Stabilize teeth following acute trauma.

Contraindications for Splinting:

- 1) When the treatment of inflammatory periodontal disease has not been addressed.
- 2) When occlusal adjustment to reduce trauma and /or interferences has not been previously addressed.
- 3) When the sole objective of splinting is to reduce tooth mobility following the removal of the splint.

Studies have showed an increase in bone loss and attachment loss in teeth with mobility and fremitus. Tooth mobility can be caused by a number of reasons including, trauma from occlusion, loss of alveolar bone and periodontal attachment and periodontal inflammation.

In fact, splinting teeth that are in hyperocclusion may be detrimental to other teeth in the splint.

A number of studies have showed no difference in teeth that were splinted during or after initial therapy (scaling and root planing), or osseous resective surgery compared to teeth that were not splinted.

While the data is limited, it may be prudent to limit a tooth's mobility in excessively mobile teeth when considering regenerative procedures.

Other factors that contribute to tooth mobility include:

- The number and distribution of the remaining teeth in the arch.
- The number of roots, root form, root proximity, amount of interradicular bone, and a history of root amputation.

Increased Versus Increasing Tooth Mobility:

Two clinical features should be analyzed to understand the full scope of the relationship between occlusal trauma and tooth mobility:

The first is *increased tooth mobility*. This process is the adaptation of the periodontium to occlusal forces that may not necessarily be considered pathologic. In the absence of inflammation, mobile teeth with a complete and healthy connective tissue attachment can be maintained.

The radiographic appearance of a widened periodontal ligament (PDL) space coupled with a clinical diagnosis of increased tooth mobility may merely be manifestations of adaptive changes to increased functional demand.

Removal of the excess occlusal load through equilibration and, perhaps, conventional splint therapy can decrease and, often times, eliminate tooth mobility. An occlusal equilibration that equalizes the occlusal stresses, produces simultaneous tooth contacts, or harmonizes cuspal relations may be all that is needed to reverse this hypermobility.

The second clinical feature is *increasing tooth mobility*. This clinical condition is best managed by treating any localized inflammation, performing an occlusal equilibration, and perhaps stabilizing or splinting the affected mobile teeth. Consequently, patients diagnosed with *increased tooth mobility* may need only an occlusal equilibration and, perhaps, conventional splint therapy. Those individuals diagnosed with *increasing tooth mobility* must first receive periodontal therapy. Treatment should include an occlusal analysis and equilibration, if needed, followed by a reevaluation for extraction or splinting of the affected teeth.

Principles of Splinting:

The main objective of splinting is to decrease movement three - dimensionally. This objective often can be met with the proper placement of a cross - arch splint. Conversely, unilateral splints that do not cross the midline tend to permit the affected teeth to rotate in a faciolingual direction about a mesio - distal linear axis.

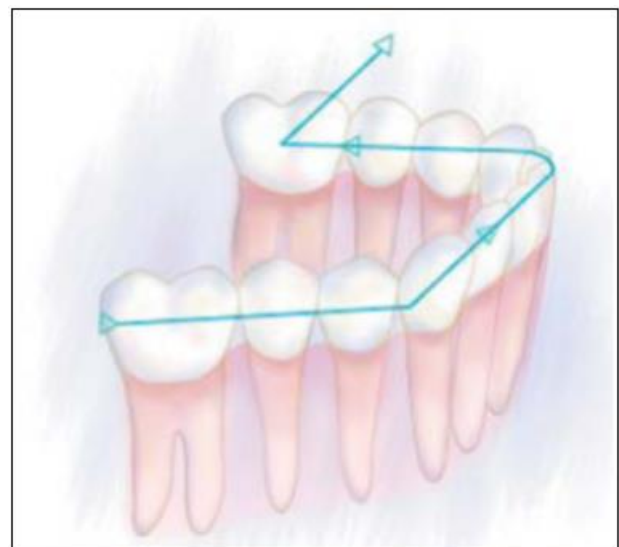


Figure 1: Polygonal design for splints to obtain cross- arch stabilization

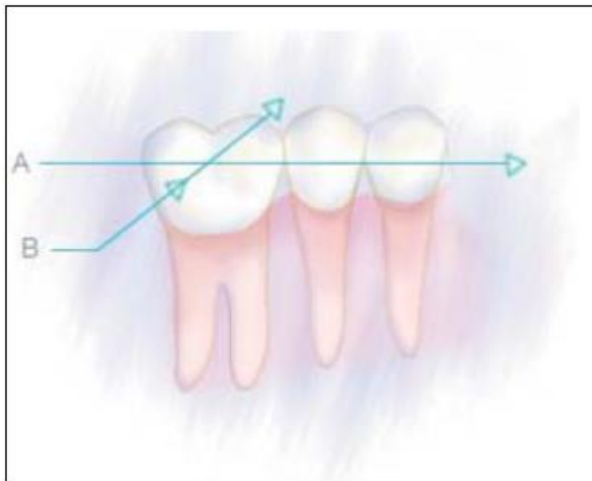


Figure 2: Unilateral design, where the entire splint can rotate in a buccal-lingual direction (B) over a mesio-distal linear axis and produce horizontal forces (A)

If splinting is to achieve any measure of success, the center of rotation of the affected teeth must be located in the remaining supporting bone. In this way, the affected teeth are able to resist tooth movement. Otherwise, the prognosis for any splint will be unfavorable if the occlusal or masticatory forces exceed the resistance provided by the splinted teeth. Thus, the ideal splint should reorient and redirect all occlusal and functional forces along the long axis of teeth, prevent tooth migration and extrusion, and stabilize periodontally weakened teeth.

Types of Splints:

Occlusal splints can be classified as provisional or definitive depending on the type of materials used and the intended duration the splint will be in place.

The Provisional Splint:

As the name alone implies, the objective of a provisional splint is to absorb occlusal forces and stabilize the teeth for a *limited* amount of time. Provisional splints can be useful adjuncts to many different types of treatment. They provide insight into whether or not stabilization of the teeth provides any benefit before any irreversible definitive treatment is even initiated.

Provisional splints can either be placed externally or internally. External splints typically are fabricated using ligature wires, nightguards, interim fixed prostheses, and composite resin restorative materials. Internal splints, on the other hand, are fabricated using composite resin restorative material with or without wire or fiber inserts.

Most provisional splints are made using some form of external support in their design. When anterior teeth require splinting, ligature wire is often used. Dead - soft round stainless steel wires (0.25 to 0.30 mm) or brass wires have been recommended. A 6 - inch section of wire is cut and placed across the anterior teeth, apical to the proximal contacts and incisal to the cervical one - third on the facial surface and cingulum on the palatal surface. Individual vertical wires are then placed between the teeth and tightened in a clockwise direction.

Occlusal devices are often recommended to patients with a history of bruxing and clenching to help stabilize teeth following selective occlusal adjustment. One of the more common devices used is a heat polymerized poly (methylmethacrylate) occlusal splint. Typically, these devices overlap the incisal and occlusal one - third of the facial surfaces of the teeth, cover the entire occlusal surfaces of the teeth, and extend onto a portion of the hard palate.

Provisional splinting can also be used when treating periodontally compromised patients with conventional fixed prosthodontics. An interim restoration not only can improve esthetics, it can restore the occlusal scheme to be incorporated into any definitive prostheses. After wearing a provisional splint, patients should be reevaluated to determine if treatment should proceed to a definitive restoration. Only after the interim restoration has been worn by the patient can the design and occlusal form be evaluated.

This evaluation should be made before deciding to proceed with the definitive restoration. Any design modifications can then be made in the definitive restoration.

For the provisional splint, the enamel surfaces are etched for 10 seconds with 35% phosphoric acid, rinsed, and a light - activated, dentin - bonding agent is immediately applied and polymerized. An appropriate shade of composite resin restorative material is selected, placed in the desired locations, and polymerized for 40 seconds. The splint can also be reinforced several ways using one of the following materials: ligature wire, glass fiber, or a polyethylene fiber reinforced polymer.

Definitive Splints:

Definitive splints are placed only after the completion of periodontal therapy and once occlusal stability has been achieved in order to eliminate or prevent occlusal trauma, increase functional stability, and improve esthetics on a long - term basis.

Such treatment includes conventional fixed prostheses because they provide definitive rigidity and are better able to control and direct occlusal forces than removable splints. For partially edentulous patients, the definitive splint of choice is a complete coverage fixed partial denture.

Fixed partial dentures not only stabilize the affected teeth, but they also improve esthetics and may even prevent further tooth loss.

Outcomes Assessment

The desired outcome of treatment of occlusal traumatism is that the patient should be able to masticate with comfort, without further damage to the periodontium.

This goal is measured by the cessation or stabilization of the presenting signs or symptoms.

These results include, but are not limited to, the following:

- 1) Mobility should either diminish or be absent or may persist if there is reduced periodontal support. A mobility pattern which is stable and allows the patient to

function in comfort without danger of further damage is an acceptable end point.

- 2) Further migration of the teeth should not occur. The migration which preceded therapy may also resolve from the alteration of the forces generated by the tongue, lips, and cheeks.
- 3) Radiographic changes diminish or become stable.
- 4) Relief of pain and improved patient comfort.
- 5) Relief of premature contacts, fremitus, and occlusal interferences.
- 6) Establishment of an occlusion that is stable, functional, physiologic, compatible with periodontal health, and esthetically acceptable.

If occlusal traumatism does not resolve, the following may occur:

- 1) Mobility continues to increase.
- 2) Tooth migration continues.
- 3) Persistence of radiographic changes, such as widening of the periodontal ligament space and periradicular or furcation radiolucencies associated with occlusal traumatism.
- 4) Patient pain and discomfort persist.
- 5) Premature contacts and occlusal interferences remain.
- 6) Parafunctional habits persist.
- 7) Temporomandibular dysfunction may worsen.

3. Conclusion

While the role of occlusion in the progression of periodontal disease has been discussed and studied for over 100 years it has been and remains a controversial subject. It is well understood that trauma from occlusion does not initiate or accelerate attachment loss due to inflammatory periodontal disease. However, questions still remain on the relationship between trauma from occlusion associated with progressively increasing tooth mobility causing an accelerated attachment loss in patients with inflammatory periodontal disease.

For these reasons when treating periodontal patients with occlusal issues the first aim of therapy should be directed at alleviating plaque - induced inflammation. Once this has been accomplished efforts can then be directed at adjusting the occlusion. This may result in a decrease in mobility, decrease in the width of the periodontal ligament space, increase in overall bone volume. Finally, in cases planned for regenerative therapy, consideration to stabilizing mobile teeth should also be given prior to surgical intervention.

References

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