



## Trauma from occlusion: a review

Commander R. "Dave" Rupprecht, DC, USN

### Introduction

Occlusion and its relationship to periodontal disease has been and remains an area of considerable controversy. Over the years, there have been a number of human and animal studies investigating this relationship. The purpose of this Clinical Update is to summarize previous research, describe the signs and symptoms of trauma from occlusion, and discuss treatment considerations.

### Definitions

Before discussing trauma from occlusion, a review of commonly used definitions will help facilitate understanding of this subject.

**Occlusal Trauma:** An injury to the attachment apparatus as a result of excessive occlusal force (1). 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 (1). 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 (1).

3) **Combined Occlusal Trauma:** Injury from an excessive occlusal force on a diseased periodontium (2). 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 (3).

**Occlusal Traumatism:** The overall process by which a traumatogenic occlusion produces injury in the periodontal attachment apparatus (3).

### Background

As far back as 100 years ago, it was felt that occlusion played a significant part in periodontal disease (4) and the formation of vertical clefts (5,6). Glickman (7,8) 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) and 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 (9,10) 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.

A number of animal studies using the Squirrel Monkey (11,12,13,14) and Beagle Dog (15,16,17,18,19,20) evaluated the effects of excessive jiggling forces in the presence of experimentally induced periodontitis. These two

groups differed in some of their findings which may have been due to differences in study design and the animal model utilized.

The conclusions of these studies are as follows:

1) Occlusal trauma does not initiate gingival inflammation.

2) In the absence of inflammation, a traumatogenic occlusion will result in increased mobility, widened PDL, loss of crestal bone height and bone volume, but no attachment loss.

3) In the presence of gingival inflammation, excessive jiggling forces did not cause accelerated attachment loss in squirrel monkeys but increasing occlusal forces may accelerate attachment loss in beagle dogs.

4) Treating the gingival inflammation in the presence of continuing mobility or jiggling trauma will result in decreased mobility and increased bone density, but no change in attachment level or alveolar bone level.

### Signs and Symptoms

When evaluating a patient suspected of having occlusal trauma there are a number of clinical and radiographic symptoms that may be present. These indicators of trauma from occlusion may include one or more of the following (21,22):

#### Clinical

- 1) Mobility (progressive)
- 2) Pain on chewing or percussion
- 3) Fremitus
- 4) Occlusal prematurities/discrepancies
- 5) Wear facets in the presence of other clinical indicators
- 6) Tooth migration
- 7) Chipped or fractured tooth (teeth)
- 8) Thermal sensitivity

#### Radiographic

- 1) Widened PDL space
- 2) Bone loss (furcations; vertical; circumferential)
- 3) Root resorption

### 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 (22):

- 1) Occlusal adjustment
- 2) Management of parafunctional habits
- 3) Temporary, provisional or long-term stabilization of mobile teeth with removable or fixed appliances
- 4) Orthodontic tooth movement
- 5) Occlusal reconstruction
- 6) Extraction of selected teeth

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 (1). 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 (23).

#### 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 (24,25,26). Burgett (27) 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 (3) 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 (28,29).

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.

The following are indications and contraindications for splinting as listed in the 1989 World Workshop in Periodontics (23).

#### 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 (30) and fremitus (26). 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 (31). 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 (32,33). While the data is limited, it may be prudent to limit a tooth's mobility in excessively mobile teeth when considering regenerative procedures (34).

#### **Summary**

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**

1. The American Academy of Periodontology. Glossary of Periodontal Terms, 3<sup>rd</sup> ed. Chicago: The American Academy of Periodontology; 1992.
2. Bowers GM, Lawrence JJ, Williams JE. Periodontics Syllabus. Washington DC: Dental Division, Bureau of Medicine and Surgery, Navy Department; 1975. NAVMED P-5110.
3. Gher ME. Non-surgical pocket therapy: dental occlusion. Ann Periodontol 1996 Nov;1(1):567-80.
4. Green MS, Levine DF. Occlusion and the periodontium: a review and rationale for treatment. J Calif Dent Assoc 1996 Oct;24(10):19-27.
5. Box HK. Experimental traumatogenic occlusion in sheep. Oral Health 1935;29:9-15.

6. Stones JJ. An experimental investigation into the association of traumatic occlusion with periodontal disease. *Proc Royal Soc Med* 1938;31:479-496.
7. Glickman I. Inflammation and trauma from occlusion, co-destructive factors in chronic periodontal disease. *J Periodontol* 1963 Nov;34(1):5-10.
8. Glickman I, Smulow JB. Effect of excessive occlusal forces upon the pathway of gingival inflammation in humans. *J Periodontol* 1965 Mar-Apr;36:141-7.
9. Waerhaug J. The infrabony pocket and its relationship to trauma from occlusion and subgingival plaque. *J Periodontol* 1979 Jul;50(7):355-65.
10. Waerhaug J. The angular bone defect and its relationship to trauma from occlusion and downgrowth of subgingival plaque. *J Clin Periodontol* 1979 Apr;6(2):61-82.
11. Lindhe J, Svanberg G. Influence of trauma from occlusion on progression of experimental periodontitis in the beagle dog. *J Clin Periodontol* 1974;1(1):3-14.
12. Lindhe J, Ericsson I. Influence of trauma from occlusion on reduced but healthy periodontal tissues in dogs. *J Clin Periodontol* 1976 May;3(2):110-22.
13. Ericsson I, Lindhe J. The effect of elimination of jiggling forces on periodontally exposed teeth in the dog. *J Periodontol* 1982 Sep;53(9):562-7.
14. Ericsson I, Lindhe J. Lack of significance of increased tooth mobility in experimental periodontitis. *J Periodontol* 1984 Aug;55(8):447-52.
15. Polson AM, Kennedy J, Zander HA. Trauma and progression of marginal periodontitis in squirrel monkeys. I. Co-destructive factors of periodontitis and thermally-produced injury. *J Periodontal Res* 1974;9(2):100-7.
16. Polson AM. Trauma and progression of marginal periodontitis in squirrel monkeys. II. Co-destructive factors of periodontitis and mechanically produced injury. *J Periodontal Res* 1974;9(2):108-13.
17. Polson AM, Meitner SW, Zander HA. Trauma and progression of marginal periodontitis in squirrel monkeys. III. Adaptation of interproximal alveolar bone to repetitive injury. *J Periodontal Res* 1976 Sep;11(5):279-89.
18. Kantor M, Polson AM, Zander HA. Alveolar bone regeneration after the removal of inflammatory traumatic factors. *J Periodontol* 1976 Dec;47(12):687-95.
19. Polson AM, Adams RA, Zander HA. Osseous repair in the presence of active tooth hypermobility. *J Clin Periodontol* 1983 Jul;10(4):370-9.
20. Polson AM. The relative importance of plaque and occlusion in periodontal disease. *J Clin Periodontol* 1986 Nov;13(10):923-7.
21. Hallmon WW. Occlusal trauma: effect and impact on the periodontium. *Ann Periodontol* 1999 Dec;4(1):102-8.
22. Parameter on occlusal traumatism in patients with chronic periodontitis. Parameters of Care. *J Periodontol* 2000 May;71(5 Suppl):873-5.
23. Proceedings of the World Workshop in Clinical Periodontics. Chicago, American Academy of Periodontology, 1989.
24. Shefter GJ, McFall WT Jr. Occlusal relations and periodontal status in human adults. *J Periodontol* 1984 Jun;55(6):368-74.
25. Pihlstrom BL, Anderson KA, Aepli D, Schaffer EM. Association between signs of trauma from occlusion and periodontitis. *J Periodontol* 1986 Jan;57(1):1-6.
26. Jin LJ, Cao CF. Clinical diagnosis of trauma from occlusion and its relation with severity of periodontitis. *J Clin Periodontol* 1992 Feb;19(2):92-7.
27. Burgett FG, Ramfjord SP, Nissle RR, Morrison EC, Charbeneau TD, Caffesse RG. A randomized trial of occlusal adjustment in the treatment of periodontitis patients. *J Clin Periodontol* 1992 Jul;19(6):381-7.
28. Nunn ME, Harrel SK. The effect of occlusal discrepancies on Periodontitis. I. Relationship of initial occlusal discrepancies to initial clinical parameters. *J Periodontol* 2001 Apr;72(4):485-94.
29. Harrel SK, Numm ME. The effect of occlusal discrepancies on Periodontitis. II. Relationship of occlusal treatment to the progression of periodontal disease. *J Periodontol* 2001 Apr;72(4):495-505.
30. Wang HL, Burgett FG, Shyr Y, Ramfjord S. The influence of molar furcation involvement and mobility on future clinical periodontal attachment loss. *J Periodontol* 1994 Jan;65(1):25-9.
31. Glickman I, Stein RS, Smulow JB. The effect of increased functional forces upon the periodontium of splinted and non-splinted teeth. *J Periodontol* 1961 Jul;32(3):290-300.
32. Kegel W, Selipsky H, Phillips C. The effect of splinting on tooth mobility. I. During initial therapy. *J Clin Periodontol* 1979 Feb;6(1):45-58.
33. Galler C, Selipsky H, Phillips C, Ammans WF Jr. The effect of splinting on tooth mobility. II. After osseous surgery. *J Clin Periodontol* 1979 Oct;6(5):317-33.
34. Garrett S. Periodontal regeneration around natural teeth. *Ann Periodontol* 1996 Nov;1(1):621-66.

Commander R. "Dave" Rupprecht is a graduate of the Periodontics program at the Naval Postgraduate Dental School and is currently Director of the 53 Area Dental Clinic at 1<sup>st</sup> Dental Battalion Camp Pendleton, CA.

The author wishes to thank Captain Brian F. Paul, Staff Periodontist at US Naval Dental Center Mid-Atlantic, Norfolk, VA, for reviewing this *Update* for accuracy and relevancy.

The opinions or assertions contained in this article are the private ones of the authors and are not to be construed as official or reflecting the views of the Department of the Navy.