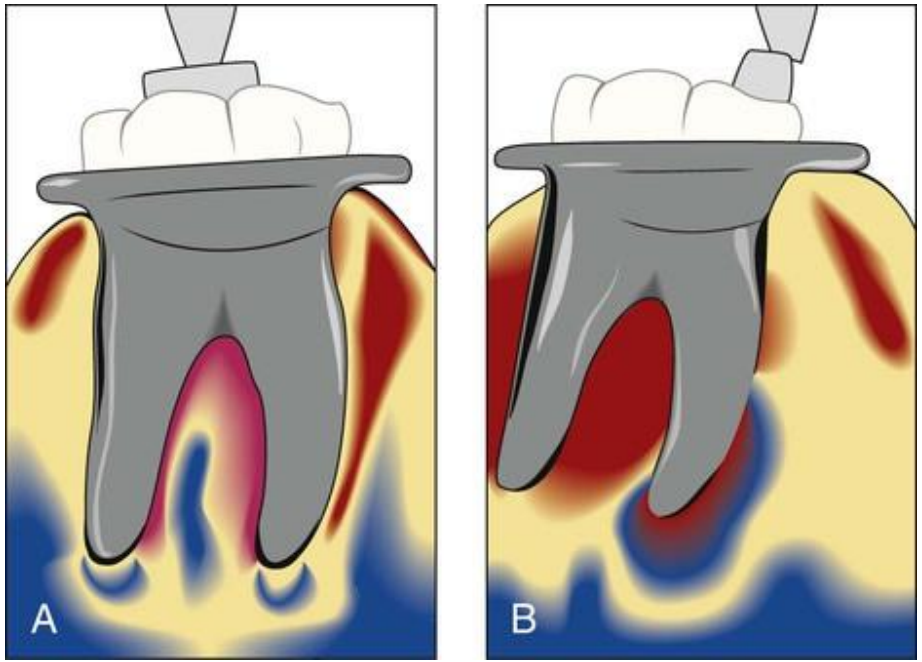

The role of occlusion in periodontal therapy

Dr Hughes & Dr Pradeep

Reading Resources

THE UNIVERSITY OF WESTERN AUSTRALIA

2017 WORLD WORKSHOP

WILEY

Occlusal trauma and excessive occlusal forces: Narrative review, case definitions, and diagnostic considerations

Jingyuan Fan | Jack G. Caton

2017 WORLD WORKSHOP

WILEY Journal of Clinical Periodontology

Periodontal manifestations of systemic diseases and developmental and acquired conditions: Consensus report of workgroup 3 of the 2017 World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions

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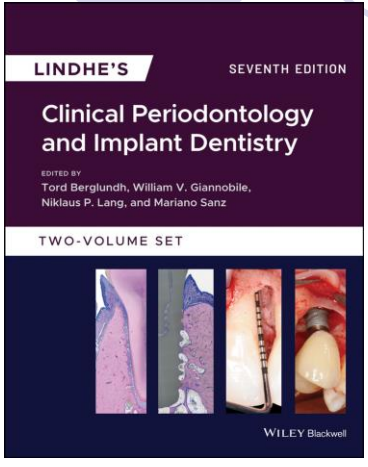
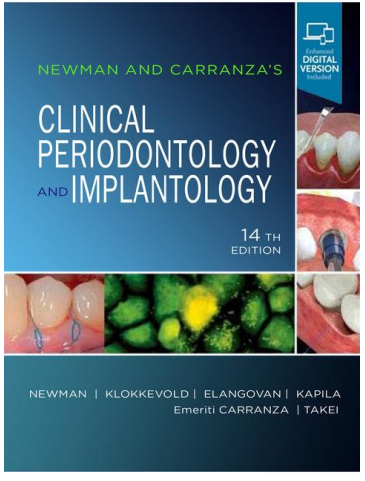
Reading resources





- 7th EDITION, Chapters 13 and 43

Aim of the lecture

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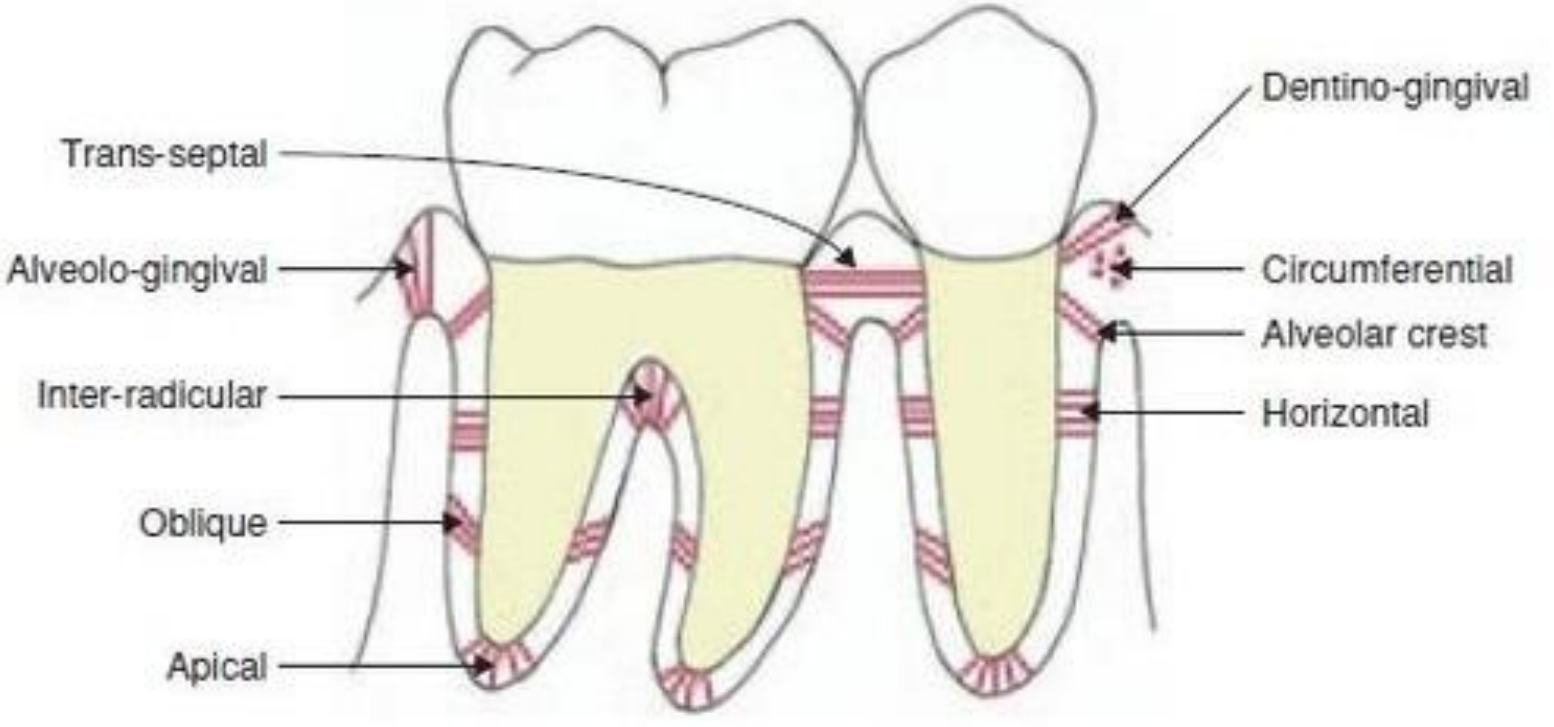
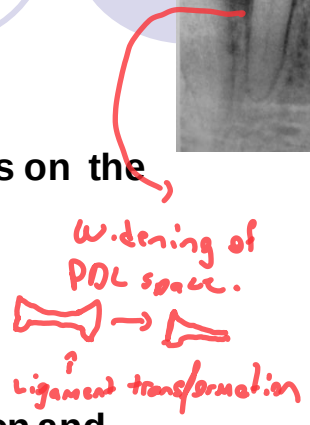
- To define occlusal trauma- PRIMARY, SECONDARY,ACUTE AND CHRONIC and its presentation
- To review the relationship between occlusal trauma and the initiation and progression of periodontitis, mobility, attachment loss and abfraction.
- To understand the causes of tooth mobility and how, why and when to treat .

Function of the periodontal ligament in occlusion

-Viscoelastic cushioning effect, absorbing occlusal forces, and adapting to variations in forces



ADAPTATIVE CAPACITY OF THE PERIODONTIUM TO OCCLUSAL FORCES explained before we define trauma from occlusion



- Mechanoreceptors and cells of the periodontium respond to variations of forces on the dentition
- Pdl fibres are best able tolerate forces down the long axis of the teeth
- Adaptive changes in the periodontium occur if the magnitude, direction, duration and frequency of the force is altered
- Changes occur in the pdl space and surrounding alveolar bone depending on the type of force- adaptive hypermobility- widening of pdl space but no pocketing
- Constant forces, lateral or rotational forces are more injurous than intermittent forces

Pockets without bone loss could be due to trauma from occlusion!

Case definitions-2017 WORLD WORKSHOP

OCCLUSAL TRAUMA AND TRAUMATIC OCCLUSAL FORCES

The group defined excessive occlusal force and renamed it *traumatic occlusal force*. *Traumatic occlusal force* is defined as any occlusal force resulting in injury of the teeth and/or the periodontal attachment apparatus. These were historically defined as excessive forces to denote that the forces exceed the adaptive capacity of the individual person or site. *Occlusal trauma* is a term used to describe the injury to the periodontal attachment apparatus, and is a histologic term. Nevertheless, the clinical presentation of the presence of occlusal trauma can be exhibited clinically as described in the case definition.

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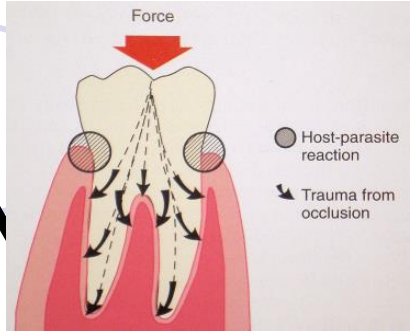
TRAUMA FROM OCCLUSION



- Trauma from occlusion is the damage or injury to the periodontium (and other structures) as a result of (excessive) occlusal forces.

- Traumatic occlusion refers to excessive and abnormal occlusal forces on a dentition (renamed *traumatic occlusal force*)

- Excessive occlusal forces is defined as an occlusal force that exceeds the reparative capacity of the periodontal attachment apparatus which results in occlusal trauma and/or causes excessive tooth wear and other injuries

NOER?

Types of Occlusal Forces

- Physiological force- 5N or less, chewing, swallowing, roughly and intermittently 5 minutes a day

  (Max bite forces-=250-850N, age, jaw shape, tooth type and sex dependent)

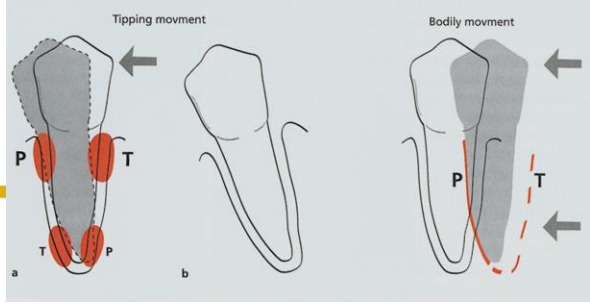
- Impact force- high but short period. If exceeds buffer capacity of the PDL- fracture of the tooth /bone

- Continuous forces- eg orthodontic tooth movement

- Jiggling forces- forces in 2 directions- eg high filling-widened PDL and mobility

- Traumatizing forces may act on one or more teeth, may be through a premature contact, bruxism or alteration of tooth position

HISTOLOGICAL DESCRIPTION OF OCCLUSAL TRAUMA-animal studies



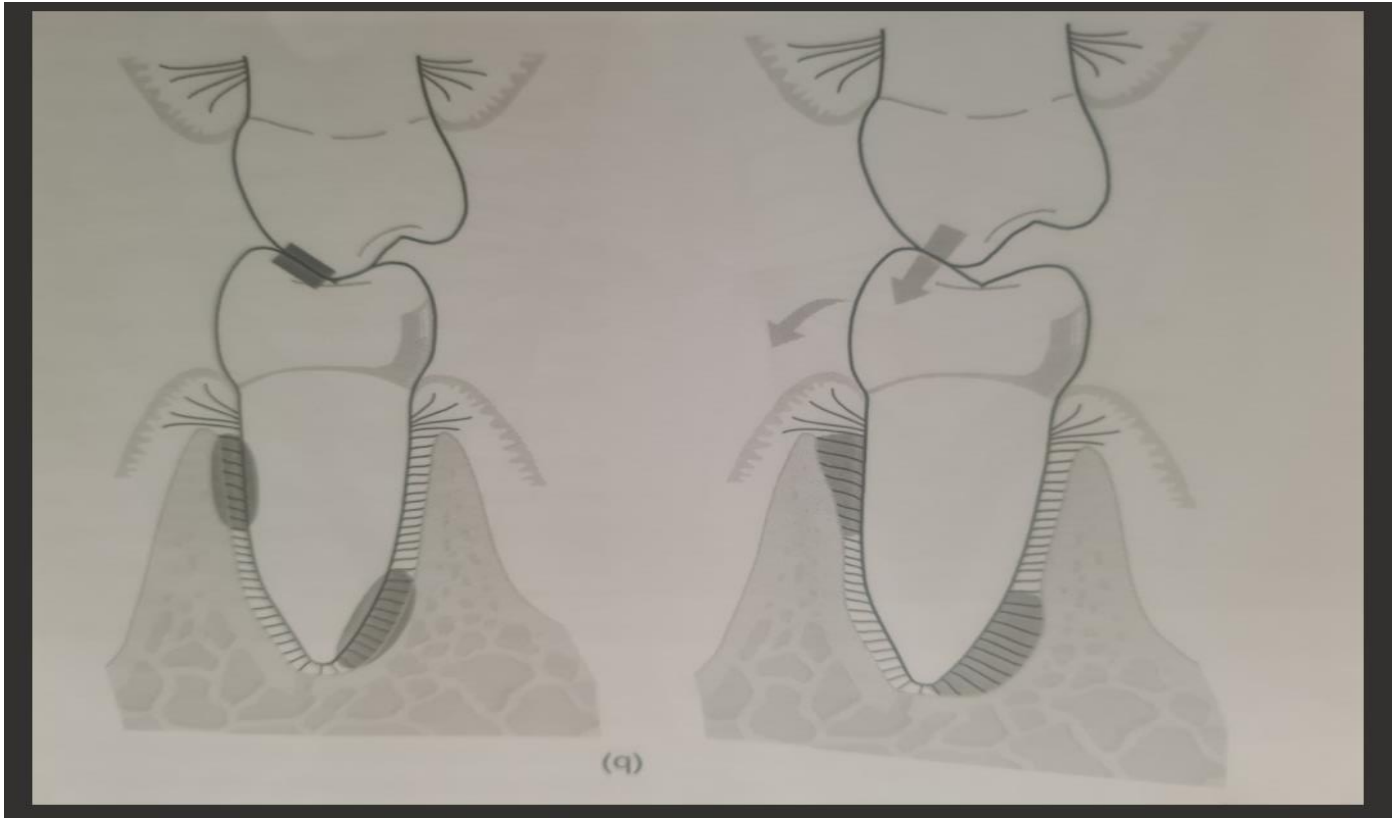
- The only accurate way of diagnosing TFO is histologically-diagrams showing orthodontic movements
- Distinct zones of pressure and tension within the periodontium- illustrated here as controlled orthodontic tooth movements
- Pressure side- mild inflammation. increased vascularization, haemorrahge, thrombois in the pdl, bone resorption , sometimes root resorption, cemental tears
- Higher magnitude of force, pdl necrosis, decomposition of cells, vessels, matrix and fibers.
- Indirect bone resorption
- Tension side – elongation of the pdl fibres, bone and cementum formation

TRAUMA FROM OCCLUSION –J
Jiggling forces ANIMAL STUDIES

JIGGLING TRAUMA Forces directed alternatively in one and another direction

- Combination of pressure and tension sites all along the root
- Mild inflammatory changes occur in the ligament causing active bone resorption
- Increased width of periodontal ligamment on both sides
- Increasing mobility
- Force compensated by tooth hypermobility but no longer progressive- ⇨ adaptation
- In a non-inflamed periodontium, supra-alveolar connective tissue remains healthy, no loss of attachment occurs, mobility remains stable

Jiggling forces on a normal healthy periodontium-hypermobility but no LOA



TISSUE INJURIES ASSOCIATED WITH TRAUMA-

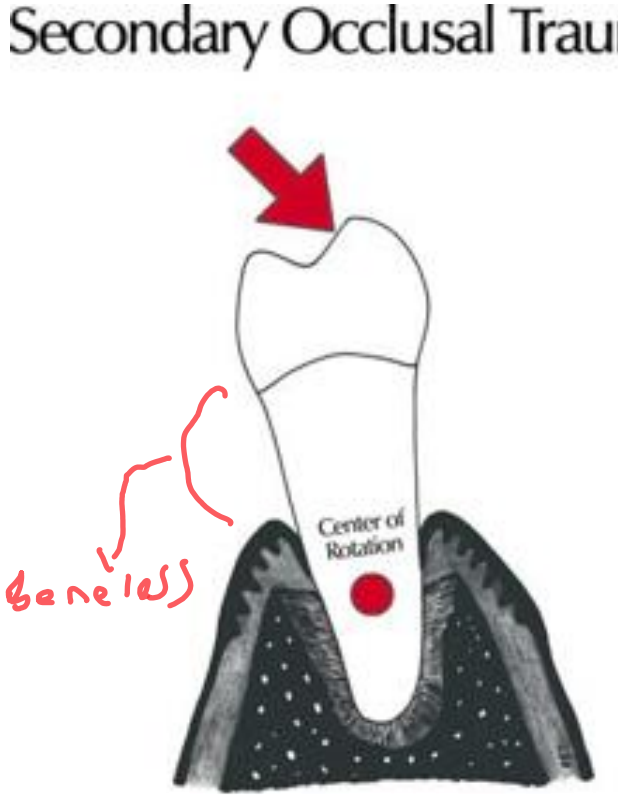
PRIMARY OCCLUSAL TRAUMA

- **Is injury resulting in tissue changes from excessive occlusal forces applied to a tooth or teeth with normal periodontal support**

Examples include

- **High filling**
- **Orthodontic treatment**
- **Prosthetic replacement high spot**
- **Extrusion of the tooth eg overeruption**
- **Bruxism**

SECONDARY OCCLUSAL TRAUMA



Is injury resulting in tissue damage from normal or excessive occlusal forces applied to a tooth /teeth with reduced periodontal support – periodontium may be healthy or diseased , force may be normal or reduced but **exceeding the adaptive capacity of the periodontium.**

Causes of primary and secondary occlusal trauma

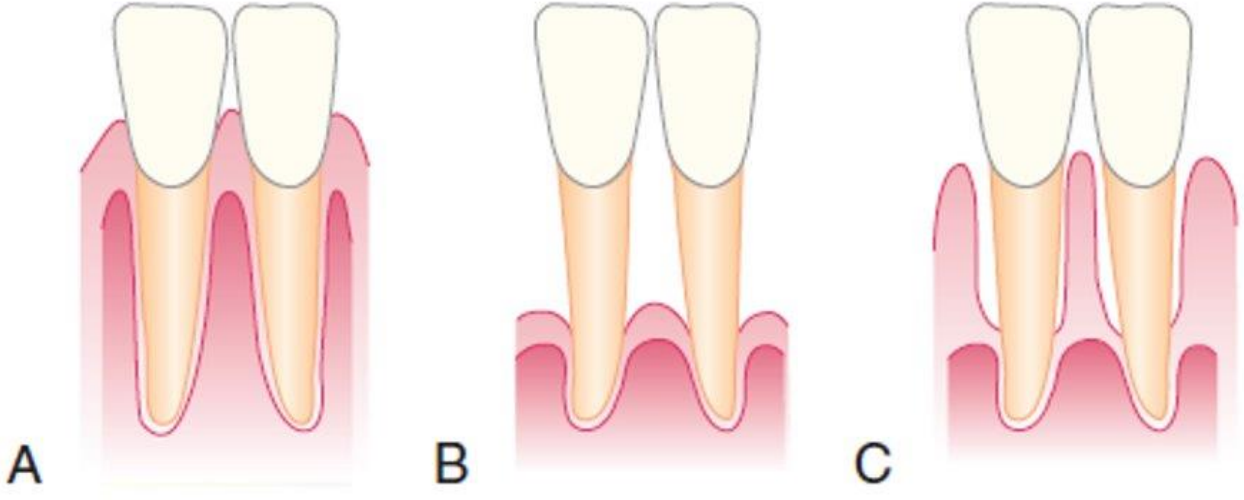


Figure 15-3 Traumatic forces can occur on **A**, normal periodontium with normal height of bone; **B**, normal periodontium with reduced height of bone; or **C**, marginal periodontitis with reduced height of bone.

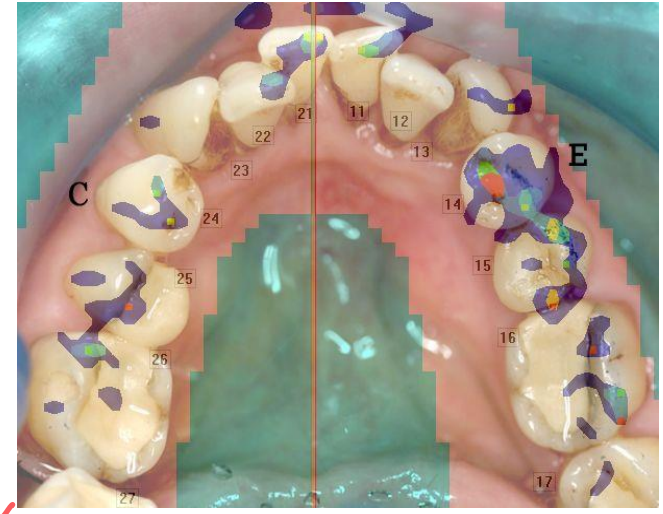
ACUTE AND CHRONIC TRAUMA DEFINITIONS

Acute trauma

Result from abrupt occlusal impact on produced by bitting or a hard object

Symptoms may include tooth pain, sensitivity to percussion, increased tooth mobility

3 main outcomes- healing, pulp/perio inflammation, acute injury becomes chronic +/- drifting



T-scan, assesses occlusal force

Chronic trauma

More common and significant than acute

Results in gradual changes

- Tooth wear
- Drifting
- Widened PDL space seen radiographically
- Commonly caused by parafunction like bruxism and clenching

An occlusion is traumatic if produces periodontal injury

MORE DEFINITIONS

- Bruxism or tooth grinding is a habit of grinding, clenching or clamping the teeth. THE FORCE GENERATED MAY DAMAGE THE TOOTH AND ATTACHMENT APPARATUS
- (The duration of the night grinding can be 5 to 38 minutes, 66% of that is generated by the masseters)

- Abfraction- -a wedge shaped defect at the CEJ thought to be caused by flexure in this area as a result of excessive occlusal forces

Fremitus – is palpable or visible movement of a tooth when subjected to an occlusal force(can indicate past disease or adaptation or an ongoing pathology)

Diagnosing trauma from occlusion

- Detailed History
- Examination -TMJ, teeth, pulp, perio, radiographs
- Unfortunately, not histology!

Traumatic occlusal forces

... Besides trauma to the periodontium, they can harm .....

TMJ

Masticatory muscles

Pulp tissue

Tooth structure

Signs and symptoms of occlusal trauma

TABLE 1 Proposed clinical and radiographic indicators of occlusal trauma

1. Fremitus	7. Thermal sensitivity
2. Mobility	8. Discomfort/pain on chewing
3. Occlusal discrepancies	9. Widened PDL space
4. Wear facets	10. Root resorption
5. Tooth migration	11. Cemental tear
6. Fractured tooth	

PDL, periodontal ligament.

Clinical signs and symptoms of trauma from occlusion

Increased tooth mobility (Physiologic and adaptive)

- Occurs as a result of adaptation to the increased occlusal force
- Can be reversed

Isolated bone loss and recession shou
raise suspicion for occlusal trauma

Progressively increasing tooth mobility (pathologic)-true diagnostic sign of trauma from occlusion

- but can be caused by other conditions
- requires repetitive assessments to determine gradual increases in mobility which is difficult (or use other indicators such as movement of teeth)
- force exceeds adaptive capability of the Pdl
- width of periodontal ligament increases
- if there is active periodontitis this may be aggravated with resultant permanent attachment loss (some evidence)

angular bone defects?

- presence of angular bone defects cannot per-se be regarded as an exclusive symptom of trauma from occlusion

- But remember that not all tooth mobility is caused by occlusal trauma

Can traumatic occlusal forces initiate or aggravate inflammation in the periodontium??

Historical theories of the role occlusal trauma in initiation and progression of periodontitis

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Yes occlusal trauma can initiate / cause periodontitis camp

Karolyu, 1901,
Stones 1938 in animal model
Carranza 1939 in cadavers

Glickman concept (human autopsys)

Believed occlusal trauma was related to the development of angular / infrabony defects and deepening of periodontal pocket

NO IT DOESN'T CAMP

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- Bhaskar & Orban 1955 – animal model (dogs)
- Ewen et al 1962 – animal model (dogs)
- Polson et al 1974 – animal model (monkeys)
- **Waerhaug concept/theory** (autopsy material)

- **Concluded that without plaque, occlusal trauma did not cause periodontitis or angular bone defects**

- **Angular bone defects occured at sites not affected by occlusal trauma**

- These changes are reversible in that they can be repaired if the offending forces are removed.

- However, persistent trauma from occlusion results in funnel-shaped widening of the crestal portion of the periodontal ligament with resorption of the adjacent bone.

- These changes, which may cause the bony crest to have an angular shape, represent adaptation of the periodontal tissues aimed at “cushioning” increased occlusal forces; however, the modified bone shape may weaken tooth support and cause tooth mobility.

- When it is combined with inflammation, TFO may aggravate the bone destruction caused by the inflammation and results in bizarre bone patterns

TOOTH MOBILITY-most common symptom

- Physiological mobility -limited normal movement of the crown in horizontal, vertical and rotational directions
- Periodontometer
- Periotest meassures reaction to the periodontium to percussion forces
- Used in clinic and research settings

Everyday clinical settings-

NORMAL TOOTH MOBILITY

Each tooth has a physiologic mobility in horizontal vertical and rotational direction

It varies among healthy persons

It varies also within 24hour cycle, the teeth are more mobile in the morning than in the evening

The mobility depends on Root surface area available for the insertion of sharpey's fibers:

- Number of roots
- Length of roots
- Diameter of roots

Normal tooth mobility varies between different types teeth:

Incisors	-	10- 12 mm/ 100 mm
Canines	-	5 - 9mm/100mm
Premolars	-	8 - 10mm/100mm
Molars	-	4 - 8mm/100mm

Miller Classification (1950) of Increased Tooth Mobility

- Degree 0: "physiological" mobility measured at the crown level. The tooth is mobile within the alveolus to approximately 0.1–0.2 mm in a horizontal direction.
- Degree 1: increased mobility of the crown of the tooth to at the most 1 mm in a horizontal direction.
- Degree 2: increased mobility of the tooth exceeding 1 mm in a horizontal direction.
- Degree 3: severe mobility of the crown of the tooth both in horizontal and vertical directions impinging on the function of the tooth.

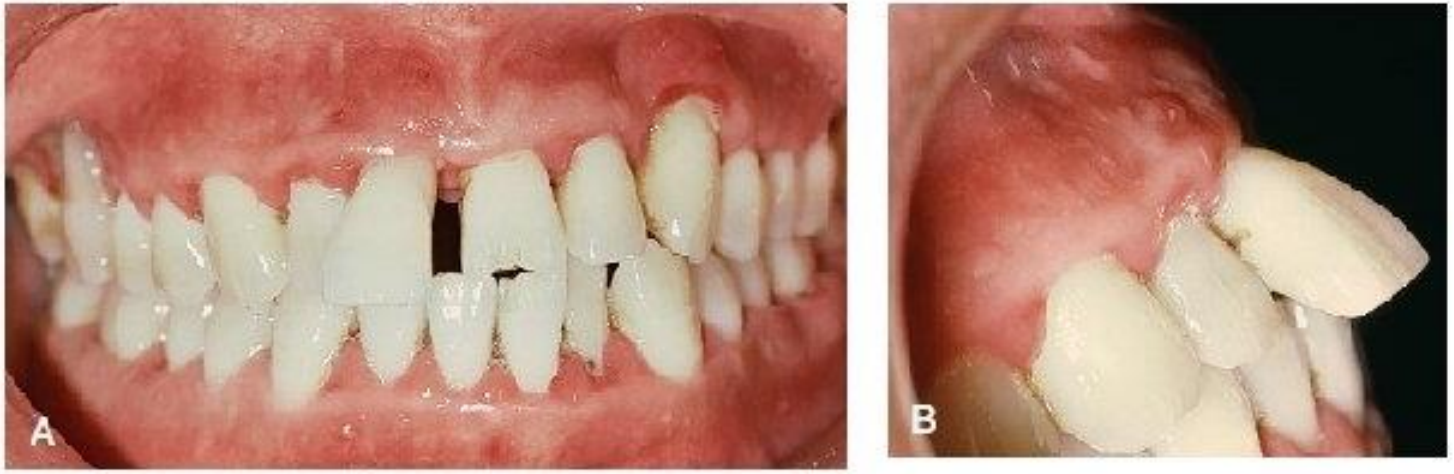
Mobility

Aetiology:

1. Advanced bone loss (periodontal disease),
2. Inflammation of the periodontal ligament of periodontal or periapical origin,
3. Some systemic causes (e.g., pregnancy),
4. The destruction of surrounding alveolar bone, such as occurs with osteomyelitis or jaw tumours,
5. Overloading of teeth and occlusal trauma,
6. Increased Immediately following periodontal surgery.
7. Root resorption
8. Root fractures

Other signs of occlusal trauma

Pathological Tooth Migration



Labial Migration of Upper central incisors

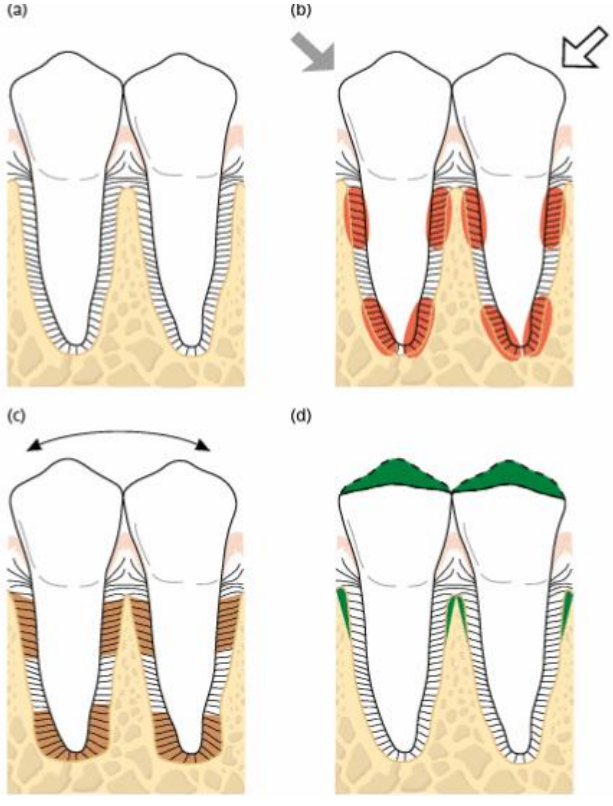
EFFECTS OF ORTHODONTIC FORCES ON THE PERIODONTIUM

- Clinical studies have shown with good plaque control teeth with reduced periodontium can undergo successful orthdontic treatment without injury
- However a non-controlled orthodontic force can injure the periodontium and cause root resortion, pulp disorders and bone loss

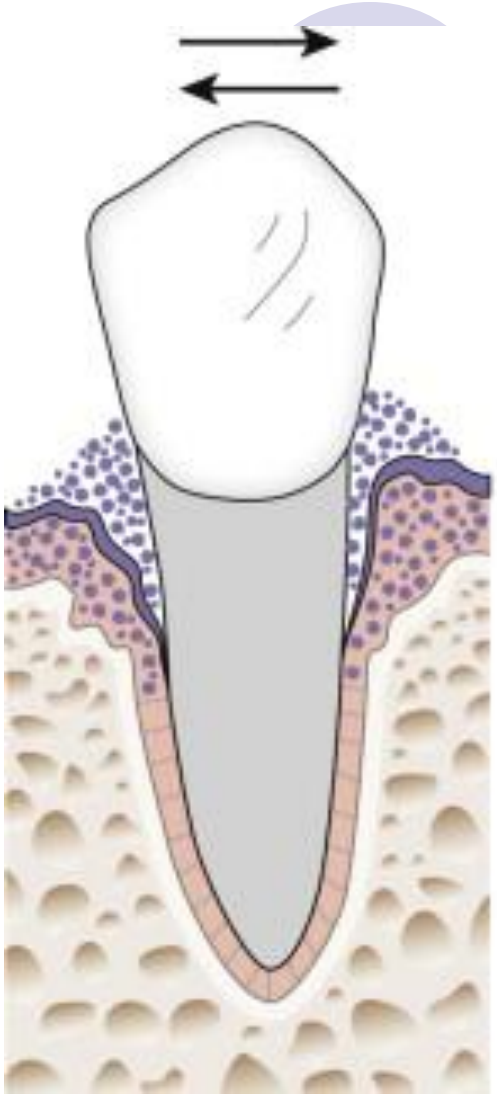
- Long term effects of orthodontic forces on the periodontium has been controversial.
- Plaque control more difficult during orthodontic treatment- more gingivitis
- Transient mobility common while the alveolar bone,gingivae and periodontium are being remodelled
- If there is existing periodontitis orthodontic treatment may aggravate the disease
- Longterm retainers / fiberotomy to prevent relapse post- ortho

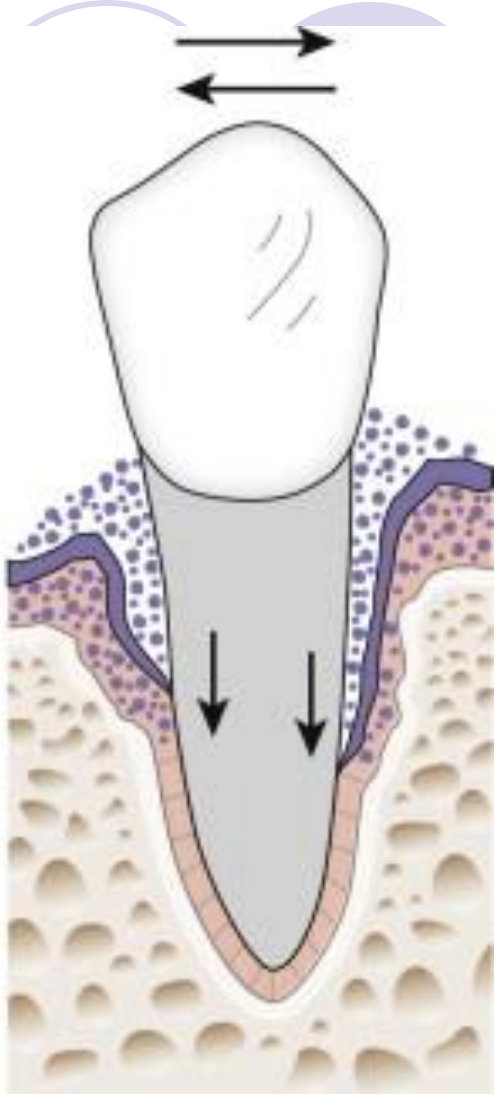
OCCLUSAL TRAUMA CAUSING INCREASED MOBILITY AND WIDTH OF THE PDL IN A HEALTHY PERIODONTIUM-JIGGLING FORCES

- Mobility and wider pdl are a result of physiological adaptation to the altered functional demands.
- Occlusal adjustment will eliminate the excess force
- Bone deposition occurred
- Hence alveolar bone loss as a result from trauma from occlusion is reversible



Jiggling forces





Jiggling forces on a healthy but reduced periodontium- before and after occlusal adjustment

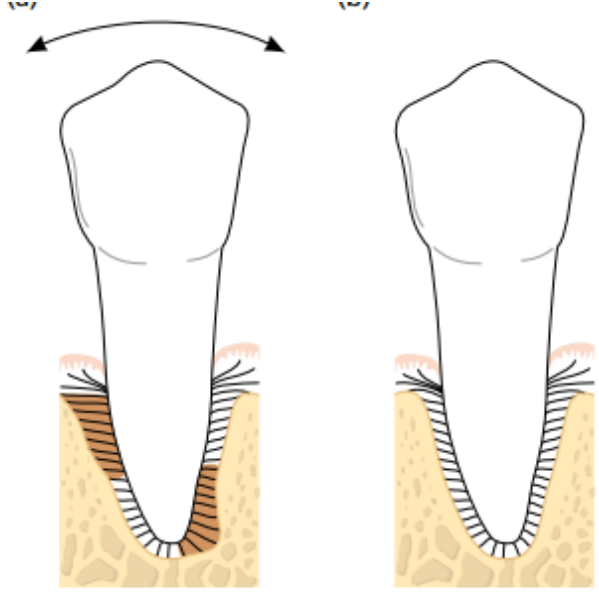


Fig. 43-5 If a tooth with reduced periodontal tissue support (a) has been exposed to excessive horizontal forces, a widened periodontal ligament space ("brown" areas) and increased mobility (arrow) result. (b) Following reduction or elimination of such forces, bone apposition will occur and the tooth will become stabilized.

- Increased mobility as a result of occlusal trauma in teeth with a reduced periodontiuin is also reversible- bone apposition to pre- trauma level occurs

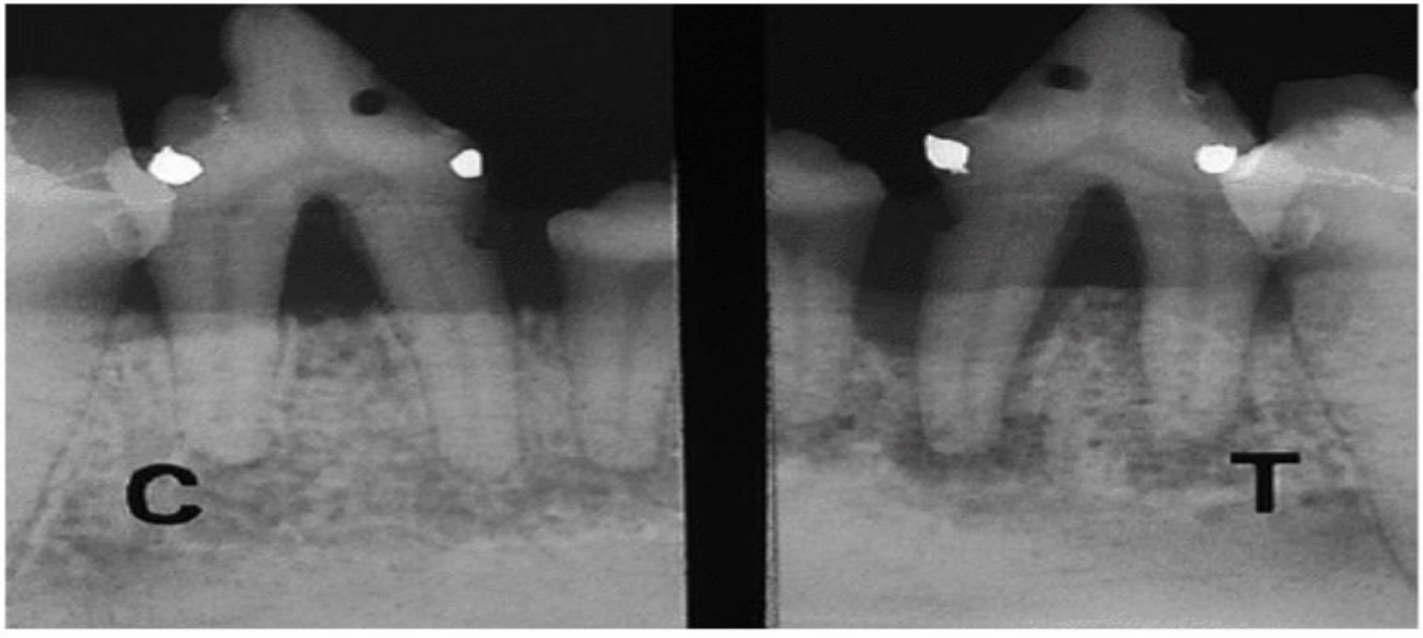
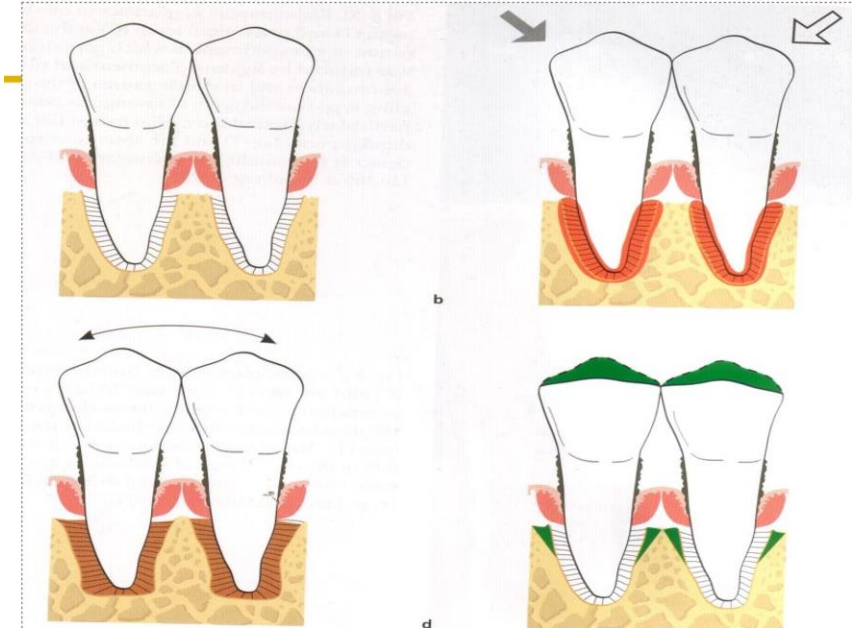


Fig. 13-7 Radiographic appearance of one test tooth (T) and one control tooth (C) at the termination of an experiment in which periodontitis was induced by ligature placement and plaque accumulation, and in which trauma of the jiggling type was induced. Note the angular bone loss particularly around the mesial root of the mandibular premolar (T) and the absence of such a defect at the mandibular premolar (C). (Source: Lindhe & Svanberg 1974. Reproduced with permission from John Wiley & Sons.)

Jiggling forces in a periodontitis patient

- The trauma from occlusion will cause increased mobility and width of pdl space.
- In most cases no further loss of attachment occurs- occlusal adjustment should result in decreased mobility to pre-trauma level
- It is vital to treat the plaque associated periodontitis as well
- Some evidence to show mobile teeth heal less well after perio treatment



WILEY

Occlusal trauma and excessive occlusal forces: Narrative review, case definitions, and diagnostic considerations

Jingyuan Fan | Jack G. Caton

What is the evidence that abfraction exists?

Abfraction, a term used to define a wedge-shaped defect that occurs at the cemento-enamel junction of affected teeth, has been claimed to be the result of flexure and fatigue of enamel and dentin. The existence of abfraction is not supported by current evidence.

Can traumatic occlusal forces cause gingival recession?

There is evidence from observational studies that occlusal forces do *not* cause gingival recession.[37, 38]

Does traumatic occlusal force or occlusal trauma cause periodontal attachment loss in humans?

There is no evidence that traumatic occlusal force or occlusal trauma causes periodontal attachment loss in humans.

Can traumatic occlusal force cause periodontal inflammation?

There is limited evidence from human and animal studies that traumatic occlusal forces can cause inflammation in the periodontal ligament.[3]

Does traumatic occlusal force accelerate the progression of periodontitis?

There is evidence from observational studies that traumatic occlusal forces may be associated with the severity of periodontitis.[34] Evidence from *animal* models indicate that traumatic occlusal forces may increase alveolar bone loss.[35], [36] However, there is no evidence that traumatic occlusal forces can accelerate the progression of periodontitis *in humans*.

Does the elimination of the signs of traumatic occlusal forces improve the response to treatment of periodontitis?

There is evidence from one randomized clinical trial that reducing tooth mobility may improve periodontal treatment outcomes.[43] There is insufficient clinical evidence evaluating the impact of eliminating signs of traumatic occlusal forces on response to periodontal treatment.

Rosling et al 1976

Pihlstrom et al 1986

Trauma from occlusion in the presence of periodontal disease

ANIMAL STUDIES

- **Reduced healthy periodontium** similar results as previous- no loss of attachment with occlusal overload
- **Plaque associated** periodontal disease- conflicting results
- Jiggling forces of magnitude and direction where pressure and tension areas exceed adaptation, areas of permanent injury, inflammation ,angular bone destruction and apical migration of junctional epithelium seen
- In dog studies- tissue destruction seen
- In monkey studies , no migration of connective tissue attachment

TRAUMA FROM OCCLUSION AND PERIODONTAL DISEASE

HUMAN CLINICAL TRIALS

- Increased tooth mobility a sign of occlusal trauma
- conflicting data regarding periodontal condition and occlusal trauma
- some support the concept that trauma from occlusion has detrimental effect on periodontium

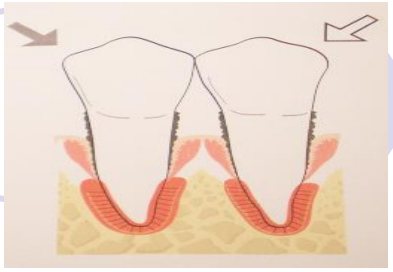
Clinical trials- mixed conclusions

- Pockets of mobile teeth do not respond as well to periodontal treatment- Fleszar et al 1980, Burgett et al 1992, Nunn and Harrel
- (2001)

- Multiple intrabony defects in patients with advanced periodontitis exhibited the same healing at hypermobile teeth compared with firm teeth after periodontal treatment -Rosling et al 1976

- Beagle dog studies showed probe tip penetrated deeper (0.5mm) at mobile teeth (Neiderud et al 1992)

CONCLUSION



ANIMAL AND HUMAN STUDIES CONCLUDED

- Unilateral or jiggling forces in a healthy periodontium does not result in attachment loss
- Trauma from occlusion can result in alveolar bone resorption leading to tooth mobility, which may be transient or permanent
- In physiologic adaptation -no loss of connective tissue attachment occurs
- Teeth with **plaque associated** periodontal disease trauma from occlusion ~~may~~ will enhance rate of progression of periodontal disease
- Treatment must be directed at controlling plaque-induces inflammation and occlusal adjustment or splinting may control mobility

WHEN TO TREAT MOBILITY..

- If there is pain /discomfort as a result of occlusal trauma (eg premature contact/high spot- selective tooth adjustement) in a normal or reduced periodontium

- Poor aesthetics (eg migration of teeth)
- Loss of posterior support (provision of denture to restore post support)

- During long term periodontal maintenance to control parafunctional habits and the effects on the periodontium (mouth guards)

- Progressing or pathological mobility as a result of periodontitis-treatment of pathology first (perio treatment can reduce mobility by 20-50%)

- Progressive mobility on a reduced periodontium where the adaptive capacity has been exceeded- patient comfort

- Pre-regenerative surgery

Treatment of increased tooth mobility

mostly for patient comfort

- Control inflammation / exclude other etiological factors.
- Correction of anatomy of occlusal surface - new restoration or selective occlusal adjustment

- Splinting teeth - splint can be
  1. Joined composite filling/ fibres
  2. Orthodontic wires
  3. Fixed bridges
  4. Cross arch splint with balanced contact for all excursive movements

- Orthodontic movement to correct position of teeth

- Mouthguard/occlusal splint
- Provide posterior support

THANK YOU