Trauma from Occlusion:
Physical, Biological, and clinical aspects

Hamad Alzoman, BDS, M.S.
Diplomate, The American Board of Periodontology
Adaptive capacity of the periodontium to occlusal forces

**Components of Force:**
- Magnitude – amount of force
- Direction – where the force is applied
- Duration – how long the force is applied
- Frequency – how often the force is re-applied
Occlusal Forces on Teeth

<table>
<thead>
<tr>
<th>Type</th>
<th>Duration</th>
<th>Magnitude</th>
<th>Duration &amp; Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functional (Chewing)</td>
<td>0.3 – 0.5 sec (17.5 min/day)</td>
<td>8 - 60 N/mm²</td>
<td>Short Duration Low Magnitude High Frequency</td>
</tr>
<tr>
<td>Parafunlctional (Bruxism, other habits)</td>
<td>2.7 – 66 sec</td>
<td>1000 N/mm²</td>
<td>Long Duration Heavy Magnitude ? Frequency</td>
</tr>
</tbody>
</table>

- Natural Teeth can generate 144 – 2440 N (most around 150–500)
- Molar Bite Force 4x Incisor Bite Force
Trama from Occlusion
Force

Preiodontium
Trauma from Occlusion

- **Introduction:**
  - “Margin of safety”

- **Occlusal forces > adaptive capacity → Trauma from Occlusion**

  - Refers to **tissue injury** (injury to periodontium) **NOT** the occlusal force

- **Any occlusion** can produce periodontal injury – malocclusion is not necessary
Trauma from occlusion

Chronic

Acute
Acute & Chronic Trauma

- **Acute trauma:**
  1. Sudden occlusal impact
     - E.g. biting on olive pit, piece of stone in flalfel
  2. Restorations or prosthetics may alter occlusal forces
  3. Signs and Symptoms
     - Tooth pain, sensitivity to percussion
     - Increasing tooth mobility
     - Identification of cause $\Rightarrow$ symptoms subside, injury heals
Acute & Chronic Trauma

**Chronic trauma:**
- Develops over time
- Tooth wear, drifting movement combined with parafunctional habits ⇒ create gradual changes in occlusion
- More difficult to treat
Trauma from Occlusion

Primary

Secondary
Primary Trauma from Occlusion

**Etiology:**

- Increase in occlusal force (direction or quantity)
- Periodontal structures relatively healthy
- Occurs with:
  - High filling
  - Prosthetic replacement or failure to replace tooth/teeth
  - Orthodontic movement of teeth into functionally unacceptable positions
Primary trauma from occlusion

- *We do not see:*
  - Changes in clinical attachment levels
  - Development of pockets
Secondary Trauma from Occlusion

**Etiology:**
- Adaptive capacity of tissues is impaired as a result of bone loss
- Periodontium more susceptible to injury
- Previously well-tolerated forces become excessive
Secondary Trauma from Occlusion

- Does not cause periodontal disease
- Bone loss & increasing tooth mobility will result
Etiology of periodontal occlusal Trauma

1) Situations increase the magnitude and frequency of occlusal forces:

- Para functional habits such as clenching, bruxism and chewing on pipe stems.
- Para functional habits stimulated by occlusal interferences such as centric prematurities & balancing side contacts.
- Fixed and removable prosthetic appliances.
2) Situations that change the direction of occlusal forces so they are not directed along the long axes of the teeth.

- Tipping forces from occlusal interferences such as centric prematurities and balancing side contacts, occur on inclined planes.
- Para functional habits in extreme eccentric positions.
- Restorative and prosthetic treatment that generate tipping occlusal forces.
- Tilting and drifting of teeth.
3) Circumstances that decreases the resistance of the periodontium to occlusal forces

- Loss of alveolar band and periodontal support.
- Loss of a number of teeth (fewer teeth to absorb occlusal load.)
4) combination of all 3 factors
Stages of Tissue Response

Injury → Repair → Adaptive remodeling
Stages of Tissue Response

- **Stage I – Injury:**
  - Changes in occlusal forces causes injury
  - Repair attempted
    - Either forces diminished
    - Tooth drifts away from forces
    - Remodeling occurs if forces are chronic
  - Varying degrees of pressure & tension create varying degrees of changes
Stage I - Injury

- Slight pressure ↑:
  - Resorption of bone
  - Widened periodontal ligament space
  - Blood vessels reduce in size

- Slight tension ↑:
  - Periodontal ligament fibers elongate
  - Apposition of bone
  - Blood vessels enlarge
Stage I - Injury

- **Greater pressure:**
  - Compression of fibers
  - Injury to fibroblasts, CT cells $\Rightarrow$ necrosis of ligament
  - Vascular changes
  - Resorption of bone

- **Greater tension:**
  - Widened periodontal ligament space
  - Tearing of ligament
  - Hemorrhage
Stage II - Repair

- Reparative activity includes formation of:
  - New CT tissue cells & fibers, bone & cementum
  - Thinned bone is reinforced with new bone – *buttressing bone formation*

- Repair occurs as long as reparative capacity exceeds traumatic forces
Stage III – Adaptive remodeling

- Forces exceed repair capacity, periodontium is remodeled
- With remodeling, forces may no longer be injurious to the tissues
- Results in thickened periodontal ligament, and angular defects *with no pocket formation*
Reversible Traumatic Lesions

- Trauma from occlusion is reversible
- Repair or remodeling occurs if:
  - Teeth can “escape” from force
  - Periodontium adapts to force
- Inflammation inhibits potential for bone regeneration – inflammation must be eliminated
TFO and periodontitis

TFO + Periodontitis → More bone loss
TFO and periodontitis

Ligature periodontitis

Ligature periodontitis + trauma
Clinical Signs and Symptoms

- Tooth mobility
- Fremitus
- Pain
- Tooth migration
- Attrition
- Muscle/joint pain
- Fractures, chipping
Definitions

■ Mobility:
  ■ measurement of horizontal and vertical tooth displacement created by the examiner’s force

■ Fremitus:
  ■ inspection of the vibratory patterns of teeth created by the patients occlusal force
  ■ Detected visually or by the clinicians fingertip
  ■ Our best guide as to the patients ability to displace teeth by occlusal force
Clinical Signs of Trauma from Occlusion

- Tooth mobility:
  - Occurs during injury stage (injured PL fibers)
  - Also occurs during repair/remodeling (widened PL space)
  - Tooth mobility greater than normal **BUT,**
  - Not considered pathologic unless tooth mobility is progressive in nature
Tooth mobility can also be caused by:

- Loss of tooth support
- Extension of inflammation from the gingiva or pulp
- Periodontal Surgery
- Pathology in jaws (e.g., Tumors, osteomyelitis)
Degree of Tooth Mobility

Two basic factors determine the degree of tooth mobility:

- Height of Supporting Tissues
- Widened PDL
How is Mobility Graded?

- Mobility is graded according to the ease and extent of tooth movement as follows:
  - Grade 0: physiological mobility
  - Grade 1: slightly above normal <1mm B-L
  - Grade 2: moderately above normal >1mm B-L
  - Grade 3: Severe mobility >1 mm combined with a displacement in vertical direction (tooth can be intruded).
Radiographic Signs of Trauma from Occlusion

- Widened periodontal ligament space
- Vertical defects
- Thickened lamina dura
- Hypercementosis
- Root fracture/resorption
Patient moves to left and only second premolar touch, - no canine protection (ie lack of anterior guidance)
Contacts on #13 and 20 in left lateral – working side interference
Treatment Outcomes

- Proposed by AAP (1996)
  1. Reduce/eliminate tooth mobility
  2. Eliminate occlusal prematurities & fremitus
  3. Eliminate parafunctional habits
  4. Prevent further tooth migration
  5. Decrease/stabilize radiographic changes
Therapy

- **Primary Occlusal Trauma:**
  - Selective grinding
  - Habit control
  - Orthodontic movement
  - Night guard

- **Secondary Occlusal Trauma:**
  - Splinting
  - Selective grinding
  - Orthodontic movement
Prognosis

1. Sooner it is diagnosed the better
2. Periodontal disease compromises healing
3. Inflammatory pathway altered – vertical bone loss
4. Height of alveolar bone
5. Forces:
   - Change in direction: most harmful
   - Distribution of forces
   - Duration
   - Frequency: continuous vs. intermittent
Unsuccessful Therapy

1. Increasing tooth mobility
2. Progressive tooth migration
3. Continued patient discomfort
4. Premature contacts remain
5. No change in radiographs/worsening
6. Parafunctional habits remain
7. TMJ problems remain or worsen
Trauma from Occlusion

- **Remember:**
  - Trauma from occlusion does not cause:
    - Gingivitis
    - Periodontitis
    - Pocket formation
    - Clinical attachment loss
  - Treat inflammation before occlusal correction