Occlusion

In a dental context, simply means the contact between teeth. More technically, it is the relationship between the maxillary (upper) and mandibular(lower) teeth when they approach each other, as occurs during chewing or at rest.

Malocclusion is the misalignment of teeth and jaws, or more simply, a "bad bite". Malocclusion can cause several health and dental problems.

Static occlusion refers to contact between teeth when the jaw is closed and stationary, while **dynamic occlusion** refers to occlusal contacts made when the jaw is moving. Dynamic occlusion is also termed as articulation.

Centric occlusion is the occlusion of opposing teeth when the mandible is in centric relation. Centric occlusion is the first tooth contact and may or may not coincide with maximum intercuspation. It is also referred to as a person's habitual bite, bite of convenience, or intercuspation position.

Centric relation, not to be confused with *centric occlusion*, is a relationship between the maxilla and mandible

Assessing Occlusion

Extra-oral Assessment

- Check for facial asymmetry and skeletal discrepancies
- Measure Lower Face Height

Loss of teeth and occlusal stops can result in over-closure causing a reduced face height. Over-closure is unlikely for patients with tooth wear due to dento-alveolar compensation. Over-eruption may occur for patients due to dento-alveolar development in absence of tooth wear which may result in increased face height.

- Temporomandibular Joints

The maximum extent the patient can open is measured between the incisal edges of the upper and lower incisors. Deviation of mandible on opening or closing should be described. Clicking, crepitus and tenderness of the jaw should be noted as well.

Intra-Oral Assessment

- Intercuspal Position (ICP) / Centric Position
- Retruded Contact Position (RCP) / Terminal Hinge Axis Position
- Excursive Movements of the Mandible which include protrusion and lateral excursion

Occlusal problems

- Malocclusion* is the result of the body trying to optimize its function in a dysfunctional environment. For example, the maxilla (upper jaw) can be placed too far anteriorly compared to the mandible (lower jaw). This would be called a Class II Malocclusion. If the mandible is placed too far anteriorly compared to the maxilla, it would be a Class III malocclusion. Malocclusion can also be associated with a number of problems:
- Misaligned ('crooked') teeth
- Periodontal problems
- The temporomandibular joint (TMJ and jaw muscles).

Malocclusion can cause teeth, fillings, and crowns to wear, break, or loosen, and teeth may be tender or ache. Receding gingiva can be exacerbated by a faulty bite. If the jaw is miss positioned, jaw muscles may have to work harder, which can lead to fatigue and or muscle spasms. This in turn can lead to headaches or migraines, eye or sinus pain, and pain in the neck, shoulder, or even back. Malocclusion can be a contributing factor to sleep disordered breathing which may include snoring, upper airway resistance syndrome, and / or sleep apnea (apnea means without breath). Untreated damaging malocclusion can lead to occlusal trauma.

Treatment for occlusal problems Some of the treatments for different occlusal problems include protecting the teeth with dental splints (orthotics), tooth adjustments, replacement of teeth, medication (usually temporary), a diet of softer foods, TENS to relax tensed muscles, and relaxation therapy for stress-related clenching. Removable dental appliances may be used to alter the development of the jaws. Fixed appliances such as braces may be used to move the teeth in the jaws. Jaw surgery is also used to correct malocclusion.

Trauma from occlusion

Is a term used to describe pathologic alterations or adaptive changes which develop in the periodontium as a result of undue force produced by the masticatory muscles. Trauma from occlusion is only one of many terms that have been used to describe such alterations in the periodontium.

Other terms often used are traumatizing occlusion, occlusal trauma, traumatogenic occlusion, periodontal traumatism, overload, etc. In addition to producing damage in the periodontal tissues, excessive occlusal force may also cause injury in, for example, the temporomandibular joint, the masticatory muscles causing painful spasm, the pulp tissue or may cause excessive tooth wear.

Traumatizing forces may act on an individual tooth or on groups of teeth in premature contact relationship; may occur in conjunction with parafunctions

such as clenching and bruxism, in conjunction with loss or migration of premolar and molar teeth with an accompanying, gradually developing spread of the anterior teeth of the maxilla, etc.

Acute and Chronic trauma

Acute trauma

Results from an abrupt occlusal impact as biting on hard object, restoration or prosthetic appliances that interfere with or alter the direction of occlusal forces. It results in tooth mobility, Sensitivity to percussion and increased tooth mobility.

If the force is dissipated by a shift in the position of the tooth or by wearing a way or correction of the restoration, the injury heals, and the symptoms subside. Otherwise, periodontal injury may worsen and develop into necrosis, accompanied by periodontal abscess formation, or may persist as a symptom-free, chronic condition. Acute trauma can also produce cementum tears.

Chronic trauma

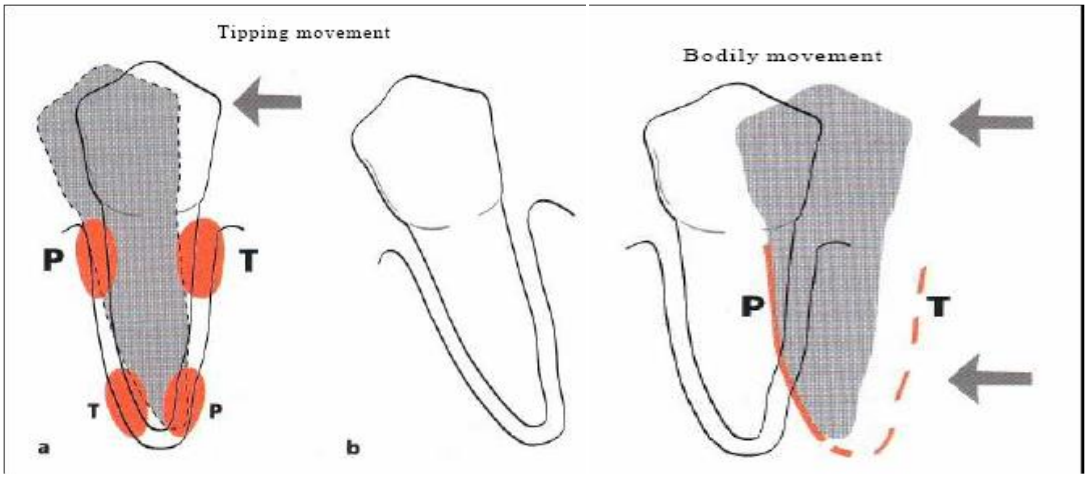
It's more common than the acute form and is of greater clinical significance. It most often develops from gradual changes in occlusion produced by tooth wear, drifting, movement, and or extrusion of teeth combined with parafunctional habits such as bruxism and clenching, rather than as sequel of acute periodontal trauma

TYPES OF OCCLUSAL FORCES:

Physiologically normal occlusal forces in chewing and swallowing: small and rarely exceeding 5 N. They provide the positive stimulus to maintaining the periodontium and the alveolar bone in a healthy and functional condition.

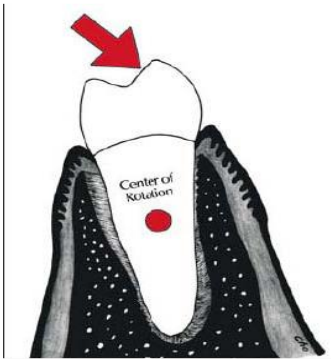
• Impact forces: mainly high but of short duration. The periodontium can sustain high forces during a short period; however, forces exceeding the viscoelastic buffer capacities of the periodontal ligament will result in fracture of tooth and bone.

• Continuous forces: very low forces (for example, orthodontic forces), but continuously applied in one direction are effective in displacing a tooth by remodeling the alveolus. *Forces in one direction: orthodontic forces bodily or tipping forces produce distinct zones of pressure and tension*

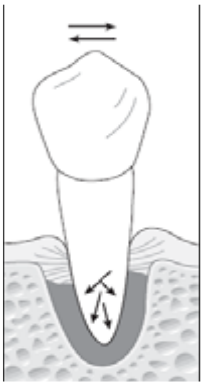


• Jiggling forces: intermittent forces in two different directions (premature contacts on, for example, crowns, fillings) result in widening of the alveolus and in increased mobility

Under the force of occlusion, a tooth rotates around a fulcrum or axis of rotation, which is in single rooted teeth is in the junction between the middle third and the apical third of the clinical root, this creates areas of pressure and tension on opposite side of the fulcrum. Different lesions produced by different degrees of pressure and tension.



when Jiggling forces, occur which is coming from different and opposite directions, cause more complex histological changes in the ligament. Theoretically the same events (hyalinization, resorption) occur, however, they are not clearly separated. There are no distinct zones of pressure and tension.



TYPES OF TRAUMA FROM OCCLUSION

The tissue injury associated with trauma from occlusion is often divided into primary and secondary

1-**Primary Occlusal trauma**

. The primary form includes a tissue reaction (damage), which is elicited around a tooth with normal height of the periodontium. Examples include periodontal injury produced around teeth with a previously healthy periodontium as

-insertion of high fillings

-insertion of prosthetic replacement that create excessive force on abutments and antagonistic teeth

-drifting movement or extrusion of teeth into spaces created by un replaced missing teeth

-orthodontic movement of teeth into functionally unacceptable position

2-**secondary occlusal trauma**

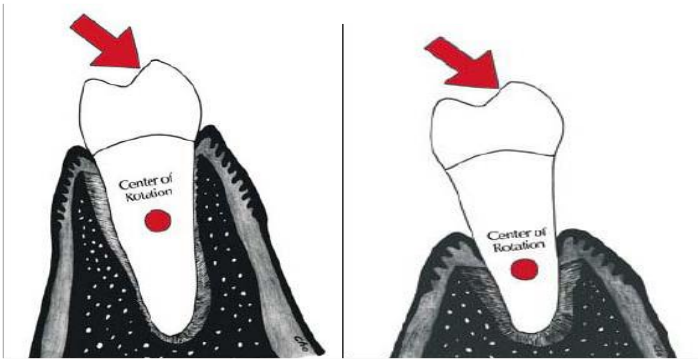
Is related to situations in which occlusal forces cause injury in a periodontium of reduced height. A third type mentioned in the literature termed and related to secondary trauma from occlusion: -**Combined Occlusal Trauma**:

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. This reduces the periodontal attachment areas and alters the leverage on the remaining tissues. The periodontium become more vulnerable to injury, and previously well-tolerated occlusal force become traumatic

The distinction between a primary and a secondary form of injury — primary and secondary occlusal trauma — serves no meaningful purpose, since the alterations which occur in the periodontium because of trauma from occlusion are similar and independent of the height of the target tissue, i.e., the periodontium. It is, however, important to understand that symptoms of trauma from occlusion may develop only in situations when the magnitude of the load elicited by occlusion is so high that the periodontium around the exposed tooth

cannot properly withstand and distribute the resulting force with unaltered position and stability of the tooth involved. This means that in cases of severely reduced height of the periodontium even comparatively small forces may produce traumatic lesions or adaptive changes in the periodontium.

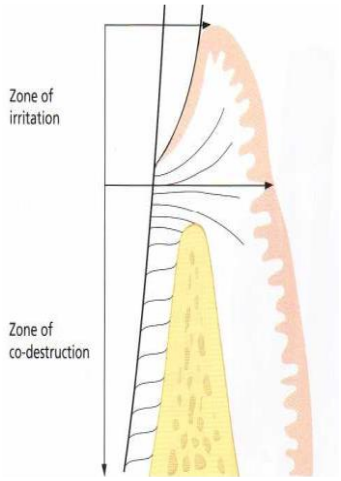
Primary occlusal trauma **Secondary occlusal trauma**



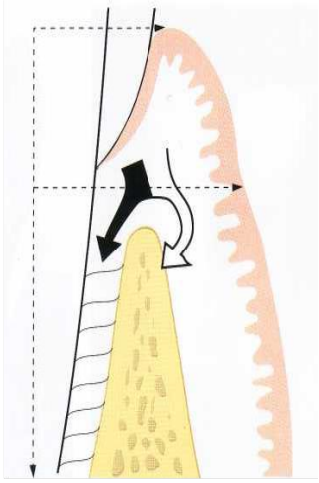
CONCEPTS OF RELATIONSHIP BETWEEN TRUMA FROM OCCLUSION AND PERIODONTAL DISEASE

1- Glickman concep

(Glickman & Smulow 1967) formulated the hypothesis that premature contacts and excessive occlusal forces could be a co-factor in the progression of periodontal disease by changing the pathway and spread of inflammation into the deeper periodontal tissues. Glickman hypothesised that the gingival zone was a *'zone for irritation'* by the microbial plaque; the supracrestal fibres were then considered to be a *'zone of co-destruction'* under the influence of a faulty occlusion



Schematic drawing of the zone of irritation and the zone of co-destruction according to Glickman.



The inflammatory lesion in the zone of irritation can, in teeth not subjected to trauma, propagate into the alveolar bone (open arrow), while in teeth subjected to trauma from occlusion, the inflammatory infiltrate spreads directly into periodontal ligament (filled arrow).

2-Waerhaug's concept

He concluded from his analysis that angular bony defects and infrabony pockets occur equally often at periodontal sites of teeth which are not affected by trauma from occlusion as in traumatized teeth. In other words, he refuted the hypothesis that *trauma from occlusion* played a role in the spread of a gingival lesion into the "zone of co-destruction". The loss of connective attachment and the resorption of bone around teeth are, according to Waerhaug,

exclusively the result of inflammatory lesions associated with subgingival plaque. Waerhaug concluded that angular bony defects and infrabony pockets occur when the subgingival plaque of one tooth has reached a more apical level than the microbiota on the neighboring tooth, and when the volume of the alveolar bone surrounding the roots is comparatively large.

Periodontal response to trauma from occlusion

Stages of Tissue Response to increased occlusal forces

Stage I – Injury:

Changes in occlusal forces causes injury in this case

- Repair attempted to restore the periodontium, and this occur if the forces diminished Or Tooth drifts away from forces
    - Remodeling occurs if forces are chronic, so the periodontium remodeled to cushion its impact. the ligament is widened at the expense of bone, resulting in angular bone defects without periodontal pockets and the tooth become loose

Varying degrees of pressure & tension create varying degrees of changes. The areas of the periodontium most susceptible to injury from excessive occlusal forces are the furcation's.

Injury to the periodontium produce a temporary depression in mitotic activity and the rate of proliferation and differentiation of fibroblasts, in collagen and in bone formation. These return to normal levels after dissipation of the forces

- *Slight pressure ⇑:*
    - Resorption of bone
    - Widened periodontal ligament space
    - Blood vessels numerous & reduce in size
- *Slight tension ⇑:*
    - Periodontal ligament fibers elongate
    - Apposition of bone
    - Blood vessels enlarge
- *Greater pressure:*

- Compression of fibers which produce areas of hyalinization
- Injury to fibroblasts, CT cells ⇒ necrosis of areas of ligament
- Vascular changes: within 30 minutes, impairment and stasis of blood flow occur; at 2 to 3 hours, blood vessels appear to be packed with erythrocytes which start to fragment; and between 1 and 7 days, disintegration of blood vessel walls and release of contents into the surrounding tissues occur. in addition, increased resorption of the tooth surface occurs
- Resorption of bone

- *Greater tension:*
  - Widened periodontal ligament space
  - Tearing of ligament and resorption of alveolar bone
  - Hemorrhage and thrombosis

Stage II – Repair

Repair is constantly occurring in the normal periodontium and trauma from occlusion stimulates increased reparative activity

- *Reparative activity includes formation of:*
  - New CT tissue cells & fibers, bone & cementum are formed in an attept to restore the injured periodontium. forces remain traumatic only if the damage produced exceeds the reparative capacity of the tissues
  - Thinned bone is reinforced with new bone – (buttressing *bone formation) which is either central buttressing (restores the bony trabeculae) or peripheral buttressing (occurs in the facial and lingual surfaces of the alveolar plate)*

Repair occurs if reparative capacity exceeds traumatic forces

Stage III – Adaptive remodeling

- Forces exceed repair capacity, periodontium is remodeled to create a structural relationship in which forces may no longer be injurious to the tissues this Results in thickened periodontal ligament, *with no pocket formation and angular bone defect*
- Following remodeling, stabilization of resorption & formation occurs and return to normal

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

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
- Fremitus (sensitive)
- Pain
- Tooth migration
- Attrition
- Muscle/joint pain
- Fractures, chipping

Radiographic Signs of Trauma from Occlusion

1. Changes in shape of periodontal ligament space, bone loss

2. Thickened lamina dura:
    - Lateral aspect of root
    - Apical area
    - Furcation areas
3. Vertical destruction of interdental septum
4. Root resorption, hypercementosis

    These changes do not necessarily indicate destructive changes because they may result from thickening and strengthening of the periodontal ligament and alveolar bone, constituting a favorable response to increased occlusal force

Treatment Outcomes

- Proposed by AAP (1996)
    1. Reduce/eliminate tooth mobility
    2. Eliminate occlusal prematurity's & 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
    - inter occlusal appliance

- *Secondary Occlusal Trauma:*
    - Splinting

- Selective grinding
- Orthodontic movement

Unsuccessful Therapy

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

Experiments carried out in humans as well as animals, have produced convincing evidence that neither unilateral forces nor jiggling forces, applied to teeth with a healthy periodontium, result in pocket formation or in loss of connective tissue attachment. Trauma from occlusion cannot induce periodontal tissue breakdown.

Trauma from occlusion does, however, result in resorption of alveolar bone leading to an increased tooth mobility which can be of a transient or permanent character. This bone resorption with resulting increased tooth mobility should be regarded as a physiologic adaptation of the periodontal ligament and surrounding alveolar bone to the traumatizing forces, i.e., to altered functional demands.

In teeth with progressive, plaque-associated periodontal disease, trauma from occlusion may, however, under certain conditions enhance the rate of progression of the disease, i.e., act as a co-factor in the destructive process. From a clinical point of view, this knowledge strengthens the demand for proper treatment of plaque associated periodontal disease. This treatment will arrest the destruction of the periodontal tissues even if the occlusal trauma persists. A treatment directed towards the trauma alone, however, i.e., occlusal adjustment or splinting, may reduce the mobilityof the traumatized teeth and result in some regrowth of bone, but it will not arrest the rate of further breakdown of the supporting apparatus caused by plaque.