

Occlusion for Hygienists

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The scope of dental hygiene duties continues to expand. With this, our knowledge of functional restoration and comprehensive oral care must expand. This course serves as an introduction to occlusion and the role proper occlusion plays in maintaining a functionally healthy mouth.

In order to maintain teeth for a lifetime, dentistry must address two areas of concern: infection and function. Occlusion lies at the crossroads of these two objectives. Occlusion encompasses the entire masticatory system. This complex system is comprised of bones, ligaments, muscles, and teeth. Tooth loss due to bacterial infection, either periodontal disease or rampant caries, causes a breakdown in the masticatory system. Parallel to this, traumatic occlusion can cause acute damage to periodontal ligaments, resulting in bone loss and pocketing.

Astute clinicians recognize the shift that functional aesthetic dentistry has brought to the role of dental hygienists. The rise of adhesive materials, stronger micro-hybrid resins and porcelain restorations, make it possible for dentistry to restore both the beauty and the function of the teeth. With this comes many new challenges, and the scope of examination by the hygienist now encompasses observation of bite relationship, wear patterns, and functional trauma.

To facilitate comprehensive care, which encompasses elimination of infections, restoration of proper function, and an aesthetically pleasing smile, consider the following when completing an examination:

- N Normal tooth structure: wear patterns, abfractions, damage
- I Infection: periodontal disease or dental caries
- C Comfortable chewing functions, bite relationship
- H Healthy joints: no pain, normal range of motion
- E Esthetically pleasing smile, social well-being
- S Soft tissue evaluation, oral cancer screening

Occlusion Basics

Classification:

Developed by Dr. Edward H. Angle in the early 1900's, Angle's Classification of occlusal relationship is based upon the relationship of the first permanent molars. Normal interdigitation of the teeth can be evaluated by either position of the first molars or canines. From an occlusion standpoint, both should be evaluated and classified.

Molar Classification

- Class I Mesial buccal cusp upper first molars interdigitate in buccal groove of lower first molar
- Class II Mesial buccal cusp upper first molar is anterior to buccal groove by at least the width of a pre-molar
- Class III Mesial buccal cusp upper first molars is distal, or posterior, to mandibular first molar buccal groove by at least the width of a pre-molar.

Canine Classification

- Class I Upper cuspid in line with the embrasure of lower cuspid and lower first bicuspid
- Class II Upper cuspid is anterior to the embrasure of lower cuspid and lower first bicuspid embrasure
- Class III Upper cuspid is distal, or posterior, to the embrasure of lower cuspid and lower first bicuspid

(see Figure 1)

Normal Occlusion

Posterior teeth, when proper occlusion is present, normally do not have concave surfaces; they have convex surfaces from the cusp tip to the central fossa. Care should be taken when placing sealants and restorations not to remove groove anatomy by creating a flat or concave occlusal surface. Hygienists also need to take care in polishing restorations during continuous care visits. Use of general purpose (coarse, medium, or fine) pumice or prophyl paste can cause changes in the anatomy of composite restorations, thus altering the bite relationship.

Normal occlusion has the following characteristics:

1. Unworn teeth without dentin showing
2. Anterior contact of four incisors
3. Cuspid contact
4. Smooth transition of cemento-enamel junction
5. Normal tooth positioning, arch form, and anatomy

Should you note inconsistencies in the characteristics listed above during the examination process, you must investigate the possible causes.

1. **Normal unworn teeth without dentin showing**
Whenever dentin is visible, there is loss of enamel, either through ongoing damage or damage that has been restored. Ask yourself: "Where is the pathology? Is this situation stable?"



Figure 2
Ideal Anterior
Contact of 4 incisors



Figure 3
Problematic:
contact #9, #24 only

2. **Anterior contact of four incisors (Figure 2,3)**
This creates anterior guidance allowing posterior teeth to separate. Anterior coupling (contact) should be present. Lack of anterior guidance causes group function in the posterior. "What needs to happen to restore anterior guidance? Could this be a compelling reason to restore anterior teeth?"

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Figure 4*
Canine guidance



Figure 5*
Group function

3. **Cuspid contact** (Figure 4,5)
With lateral excursion, the canines should stay in contact and posterior teeth should separate. This is referred to as cuspid/canine guidance, canine rise, or cuspid protection. Malpositioned or worn canines can create group function and cause stress in the posterior teeth. "What are the benefits of restoring canine rise? If the patient is considering cosmetic restoration of the incisors, will lack of canine rise be a consideration with the number of teeth involved in the case?"
4. **Smooth transition of cemento-enamel junction**
Wedge defects at cervical third are usually found on facial surface, rarely on lingual. These are often known as abfractions. While mechanical abrasion rarely creates the initial pathology, it can exacerbate the situation once dentin is exposed and create new pathology. Abfractions must be evaluated for etiological origin and current pathology (i.e., mechanical abrasion, occlusal trauma, chemical erosion, or combination).
5. **Normal tooth positioning, arch form, and anatomy**
 - a. Malposition: most common malpositions
 - i. Mesio-angular molars (#2 & #3).
These functional interferences can result in avoidance patterns and wear that can affect the anterior teeth.
 - ii. Lingual inclined incisors
 - iii. Lingually inclined molars
 - b. Cross-bites generally create very few pathological conditions that necessitate correction. To fully restore a cross-bite, both upper and lower arch must be manipulated and restored to proper tooth anatomy and position.

Traumatic Occlusion

A positive diagnosis of occlusal trauma is made based on signs and symptoms of injury within the masticatory system. Hygienists need to look for the following clinical features and report findings to the dentist: mobility, migration, pain on percussion or chewing, radiographic changes in lamina dura, periodontal ligament, or radiolucencies in the furcation or apex, tenderness in the muscles of mastication, wear facets beyond expected levels for the patient's age, chipped enamel or porcelain, crown or root fractures, and fremitus. These symptoms may or may not be pathogenic. A differential diagnosis by a dentist trained in occlusal function needs to be made.

Occlusion and Smile Designs

Beautiful smile designs must be in harmony with posterior anatomy. Worn posterior teeth, flat chewing surfaces, could place abnormal stress on the anterior teeth. Without correction in the posterior, the anterior aesthetics will be out of synch with posterior function. According to Dr. Mark Montgomery and Dr. David Hornbrook of The Hornbrook Group, "Aesthetics drive the case, function finishes the case. The creation of beautiful aesthetics demands optimal function."

Areas to consider when discussing smile design options with patients include loss of vertical dimension, lack of canine guidance, group function, anterior wear facets, lack of anterior guidance. Each of these can be a symptom of bruxism, clenching, or faulty occlusion. Heavy bruxers can easily be identified by looking at general facial features. During the examination ask yourself the following questions: Has the distance between the tip of the nose and chin shortened over time? Have the muscles of mastication thickened? Is there a loss, in excess of 20%, of the natural tooth surface on the anterior teeth? Are the canines flat?

Patient's perceived need may not be in alignment with ideal care. The chief complaint may be a rotated incisor, or chipped central. Not understanding the pathological reasons for these occurrences, the patient may seek treatment for one or two teeth. Proper examination will assist the clinician in determining origin of pathology, current situation, and ideal restorative plan. The clinician will then be able to guide the patient toward the best treatment choices.

Occlusion and Periodontal Disease

The mouth is comprised of 32 teeth, each supported by periodontal supportive structure known as the periodontal ligament. Chewing forces are absorbed through these ligaments and act like shock absorbers of a car to take on the stress.

Occlusal forces may cause injury to the periodontium if the forces exceed the reparative capabilities of the periodontal ligaments. Highly suspect areas for occlusal trauma are isolated areas of vertical bone loss. Periodontal pocketing may occur in conjunction with, or independent of, inflammatory periodontal disease. According to Wilkins (p261), "Trauma from occlusion does not cause gingivitis, periodontitis, or pocket formation...in the presence of inflammatory disease, the existing periodontal destruction may be aggravated or promoted by trauma from occlusion."

If both inflammatory periodontitis and occlusal traumatism occur concurrently, each condition must be treated separately. Open dialogue between the dentist and hygienist will facilitate meaningful treatment plans to address each issue.

Occlusion and Wear Patterns

Tooth wear may or may not be attributed to bruxism. The finding that needs to be reported is *tooth wear patterns*. Noting that pathology alone would warrant further occlusal evaluation on the part of the dentist. Bruxism is a specific diagnosis that should be delivered by the dentist. Treatment options for the correction of bruxism include removable splint therapy, occlusal equilibration, and/or full-mouth restoration. These choices depend on several factors, such as characteristics of the force, the underlying cause of the trauma, support of the periodontal structures, and the function of the dentition.

Headaches / TMD

Occlusion in a broader sense encompasses the entire masticatory system. This complex system is comprised of bones, ligaments, muscles, and teeth. Movement within the system is regulated by the coordination of muscles through the neuro-muscular logic system within the brain. Hygienists must consider more than occlusion when reporting findings to the doctor regarding temporomandibular dysfunction (TMD). Make note of clicking and crepitation, as well as patient's range of motion, and dynamic movement upon opening.

Range of motion is measured from the incisal edge of the maxillary anteriors to the incisal edge of the mandibular anteriors (interincisal distance). Normal range of motion is considered 53–58 mm, or roughly three to four finger widths. Measurements below 40 mm would be considered restrictive. Bear in mind two factors: (1) patient's age, as older people tend to have a lesser range, and (2) overbite and open bite. If the patient has, for example, a 5-mm overbite, then this must be added to the interincisal distance to determine the maximum distance. Lateral movements should also be noted. As the patient slides left to right, a movement of at least 8 mm should occur. This is measured by marking the lower incisor directly below the maxillary midline with a pencil, then noting the position upon full lateral excursion. A second mark is made and the distance recorded.

Studies are mixed in their findings of a relationship between occlusion and TMD. Contributing factors to TMD include occlusal interferences, balancing interference, group function, presence of restorations, anterior open bite, overjet, overbite, cross-bite, reduced number of occlusal contacts, and lost teeth.

Much controversy exists in the treatment of functional disturbances of the masticatory system. Since 1934 when Dr. James Costen first described a group of symptoms centering around the ear and temporomandibular joint (TMJ), terminology to describe joint and facial pain has varied. In an effort to standardize terminology, the American Dental Association began to use the term TMD (temporomandibular disorders) to describe all functional disturbances in the masticatory system.

Each area of the masticatory system can tolerate a certain amount of functional change. The human body is designed to adapt to changes within these parameters. When the physiological load is exceeded, the system begins to reveal these changes, and alteration of the hard and soft tissue begins to occur. According to Okeson (p111) there are five major factors associated with TMD: (1) occlusal condition, (2) trauma, (3) emotional stress, (4) deep pain input, and (5) parafunctional activities. It is estimated that 40%-60% of the general population present with at least one clinical sign of TMD. (A sign is considered to be a clinical finding. A symptom is considered to be a sign of which the patient is aware and reports.) Approximately one in four patients will report symptoms of TMD; however, only five to ten percent of those patients present with pain or dysfunction at a level significant enough to warrant treatment. Dental hygienists need to be aware of signs and symptoms of TMD and report findings to the dentist.

Connection:

Armed with this information, how can hygienists incorporate knowledge of occlusion on a daily basis in their clinical practice? Be conscious of the proper examination sequence. Examination and treatment planning must always precede care. Oftentimes in the rush of the day, hygienists begin scaling or polishing prior to completing an examination. Based on assumptions from previous visits, it is tempting to take shortcuts, and "look while I scale", when pressed for time. To avoid this, commit to the following sequence:

1. Begin each appointment with a review of medical histories. This may offer insight into occlusal parafunction through identification of tension headaches, sinus pain, or other medical conditions that may have a dental origin.
2. Incorporate a thorough head and neck, lymph node, oral-cancer evaluation with each patient. Signs and symptoms of TMD, muscle tension, can easily be identified in this process.
3. Expand extra-oral exam to include lateral excursion, and anterior excursion to evaluate canine rise, anterior guidance, and the possibility of group function.
4. Utilize intra-oral cameras or digital photographs to assess restorations. Open margins, food impactions, faulty restorations, and wear patterns point to the need for further investigation.
5. Review radiographs in tandem with periodontal charting to identify abnormal bone patterns, thickening of periodontal ligaments, or periodontal lesions that could be aggravated by traumatic occlusion.

Connecting occlusal relationship with periodontal and restorative care helps hygienists expand their horizons and participate in comprehensive treatment planning for functional aesthetic dentistry.

Glossary of Terms:

Abfraction Non-carious cervical lesions that result primarily from the destructive effects of tooth flexure associated with stressful occlusion or para-function (e.g., bruxism, clenching).

Bite force One of the components of the chewing function. It is exerted by the jaw elevator muscles and regulated by the nervous, muscular, skeletal and dental systems.

Bruxism Habitual grinding, clenching, or clamping the teeth. This can result in damage to the teeth and attachment apparatus.

Continuing Education Test Questions Answer Sheet on Back Cover

Centric occlusion (CO) The maximum intercuspation or contact of the teeth of the opposing arches; also called habitual occlusion.

Centric relation (CR) Has had a variety of definitions over time. Generally considered to be the position of the mandible when the condyles are in an orthopedically stable position.

Concave A surface curved inward, like the inside of a bowl.

Convex A surface that curves outward rather than inward; as seen on posterior teeth, occlusal surfaces from cusp tip to central groove.

Deflection Any shift in the jaw midline to one side that becomes greater with opening and is maintained at maximum opening.

Deviation Any shift in the jaw midline during opening that disappears with continued opening.

Fremitus A vibration perceptible by palpation.

Interdigitation Meshing of the teeth; the interlocking of the upper and lower teeth (like gears in a cog).

Occlusal interferences Any early or heavy occlusal force that inhibits closure to full simultaneous contact.

Open bite Describes the inability of either the anterior or posterior teeth to fully connect in a resting position.

Parafunctional habits Abnormal or deviated function, as in bruxism, nail biting, etc.

Range of motion Normal range of mouth opening measured interincisally is between 53-58mm. Maximum opening less than 40mm is considered restricted. Lateral excursion less than 8mm is considered restricted.

Stress corrosion Accelerated loss of tooth structure when flexural stresses occur in the presence of an acidic environment.

Talon cusp Composed of normal enamel and dentin with varying extensions of pulp tissue. Large talon cusps protruding from the lingual surface of maxillary anterior teeth are associated with occlusal trauma and acute periodontitis.

Vertical dimension The distance between the maxilla and mandible, creating the vertical facial height. The buccal cusps of the mandibular posterior teeth and the lingual cusps of the maxillary posterior teeth, known as supporting cusps or centric cusps, create vertical dimension.

Resources:

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This information is an introduction to occlusion, and is not meant to be interpreted as an all-inclusive resource for the science of occlusal function. The authors state no opinion in this paper in regard to treatment of para-functional disorders, traumatic occlusion, or TMD.

1. Normal occlusion includes these characteristics:

- Unworn teeth
- Group function
- Cuspid contact
- A & C
- A & B

2. Wedge defects can be caused by the following:

- Mechanical abrasion
- Occlusal trauma
- Chemical erosion
- Combination of the above
- All of the above

3. Smile designs (anterior veneers and porcelain crowns) must be in harmony with:

- Vertical dimension
- Posterior anatomy
- Group function
- Parafunctional habits

4. Which of the following are valid functional reasons for rehabilitating the anterior teeth?

- Lack of canine rise
- Lack of anterior guidance
- Wear facets and chipped teeth
- Malpositioned teeth with otherwise functioning occlusion
- All of the above

5. Traumatic Occlusion affects periodontal disease in the following manner:

- Primary cause of periodontal inflammation
- Contributing factor to alveolar bone loss
- Has no effect on the periodontium

6. Which of the following statements are true? Periodontal disease:

- May occur independent of occlusal trauma
- May occur in conjunction with occlusal trauma
- Each contributing factor must be treated individually
- All of the above
- A & C
- B & C

7. When dentin is exposed, the correct clinical finding to be reported is:

- Bruxism
- Tooth wear patterns
- Occlusal trauma
- Abrasion

8. Approximately one in four patients will report symptoms of TMD; however, only _____ percent will present with pain or dysfunction at a level significant enough to warrant treatment. What is that percentage range?

- 3% - 5%
- 5% - 10%
- 10% - 15%

9. A patient with unrestricted range of motion should be able to open

- 30 mm – 40 mm
- 42 mm – 50 mm
- 53 mm – 58 mm
- 60 mm or above

10. Periodic examinations include evaluation of infection, soft-tissues/oral cancer, healthy joints, comfortable chewing functions, normal tooth structure, healthy joints, and esthetically pleasing smile. The acronym for this process is:

- INCHES
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