Occlusion In Dentistry

The Goal: Esthetics & Function

The Engineering = Occlusion

Teeth Foundations:
- Angle Class - Skeletal and Prosthetic
- Overjet, Overbite & Anterior Guidance
- VDO - total height & maxillary incisal edge position

Implant Foundations:
- Number of implants
- Position of the implants
- Size of the implants - RSA, dia. vs. length
- Angulation of the implants
- Crown to root ratio

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Occlusion

- Occlusion is the relationship between all the components of the masticatory system both in acceptable function and not.
- It includes the morphological and functional features of contacting surfaces of opposing teeth and restorations.
- It also includes TMJ function and neuromuscular physiology, and
- The diagnosis, prevention and treatment of functional disorders of the masticatory system.

Malocclusion

- A malocclusion is a misalignment of teeth or incorrect relation between the teeth of the two dental arches.
- The term was coined by Edward Angle, the "father of modern orthodontics", as a derivative of occlusion, which refers to the manner in which opposing teeth meet.

In the past occlusion was taught as a rigid dogma. If we saw a “malocclusion” as defined by Angle then it was considered to be “disease” which required treatment. Nowadays, unless we have to restore we do not treat malocclusion as a disease in the absence of symptoms. As long as the occlusion is functional and we are not planning extensive restorative, cosmetic or orthodontic work then we do not change the occlusal scheme. Ask yourself: Where is the wear, the sensitivity, the mobility, the cracks, fractures, pain?

Malocclusion in its strictest definition is a “mal” or bad occlusion. This means that the teeth are not fitting together harmoniously and acceptably. It has nothing to do with Angle class or aesthetics. It is only related to the occlusion or fit of the teeth and whether this fit allows the masticatory system to function properly, without TMJ pain or pathology, accelerated wear of the teeth or other actual pathologies associated with a poorly fitting bite.

Malocclusion then is any occlusion other than Acceptable Function. It includes Occlusal Dysfunction, Anterior Constriction, Parafunction and Neurological Disorders.
Diagnosing Malocclusion

- Clinical Examination- presence and location of wear facets, loss of vertical dimension, mobility, multiple missing teeth, TMJ symptoms, multiple bite positions, etc…
- Interview- Ask questions about TMJ comfort when eating. Can they eat everything comfortably or do they avoid certain harder, chewy foods? Has the wear on their teeth become worse in the last few years? Do they feel they clench or grind their teeth?
- If they answer yes to any of these questions then the diagnosis will not be acceptable function and some form of treatment will be required.

Maximum Intercuspation Position- MIP

- The complete intercuspation of opposing teeth, independent of condylar position.
- Also referred to as the “best fit” of the teeth regardless of the alignment of the condyles.

Centric Relation- CR

- The maxillo-mandibular relationship in which the condyles articulate with the thinnest avascular portion of their respective discs with the complex in the anterior-superior position against the shapes of the articular eminences.
- This position is independent of tooth contact.
- This position is clinically discernible when the mandible is directed superiorly and anteriorly.
- It is restricted to a purely rotary movement about the transverse horizontal axis.

Centric Occlusion

- The occlusion of the opposing teeth when the TMJ/mandible is in Centric Relation.
- Also called Centric Relation Occlusion.
- This may or may not coincide with maximal intercuspation position.
Booting the System.
How the Brain Finds MIP

• Teeth have PDL
• PDL has pressure sensors
• Mandible moves around trying different bite positions until it finds the one position with the maximum number of pressure sensors firing
• Brain “locks in” this muscle position (engram)
• System is now programmed to find this MIP bite or “home base”

When to Restore in MIP

• We restore in MIP most of the time provided that the patient meets the following criteria:
  • Quiet muscles.
  • When the patient has minimal to no wear on their teeth.
  • When they have no TMD symptoms.
  • When they answer no to all the questions in our screening questionnaire.
  • When they have a Functional Occlusion.
  • When we are planning minimal restorative work.

Dangers of Using MIP

• But what if we are planning to perform extensive restorative or cosmetic dentistry?
  • “Doing dentistry with occlusal changes at MIP carries the risk that the patient will be unable to re-create their engrams, the recorded programmed muscle commands in the CNS that bring the teeth to MIP when they close.”
  • In other words you can cause them to lose their “home base”.

**Tip:** *If the patient appears to have any other occlusion than a functionally healthy one, and you are planning to treat multiple teeth, whether the treatment involves major or minor restorative, then you will need to take occlusal records that capture Centric Relation not MIP. If you are not comfortable or capable of treating them then this is your time to find this out.*


When to use CR

1. When we are contemplating changing the occlusal scheme on purpose.
2. When we are going to inadvertently change the occlusal scheme, i.e. multiple restorations.
3. Anytime the patient is or will be edentulous.
4. TMD patients.

**Tip:** *It is always a good idea to consider mounted casts in CR for comprehensive treatment including multiple arch restorative. This way you can at least recognize how much of a discrepancy exists between MIP and CO and treatment plan accordingly.*
Why Use CR?

- CR is used because we need a REPEATABLE, PREDICTABLE position of closure that can be REPRODUCED on an articulator.
- When might we consider another method? When the mandible cannot be seated comfortably into CR, i.e. damaged or inflamed joints, disc displacement, etc. Consider delaying treatment or muscular positioning in these cases.

Finding CR

The Kois Deprogrammer

Uses for The Kois Deprogrammer

1. Diagnosing Clenching- if wearing it helps, they are clenching. If they break off the pad or wear it down they are grinding.
2. Finding CR by de-programming the engrams
3. Short to Medium Term Anti-Clenching Appliance
4. Treatment- Reconstructing VDO and Occlusion with Transitional Bonding
5. Treatment- Occlusal Equilibration
Can We Reliably Create a Therapeutic Occlusion?

More Importantly- When Should We Intervene?

Functional Occlusion: Essential Keys

- Envelope of function that creates an efficient use of closing and opening movements (muscles), i.e. not fatiguing.
- Envelope of function that does NOT create premature loading of teeth (wear, mobility, TMD).
- Maximum intercuspation that the brain can find repeatedly and easily.
- Maximum intercuspation that is precise (no slide) with bilateral equal intensity contact on the posterior teeth.
- All movements and terminal closure must be compatible with harmonious TMJ function.

The Diagnoses

- Functional Occlusions
  - Acceptable Function
- Malocclusions
  - Anterior Constriction
  - Occlusal Dysfunction
  - Parafunction
  - Neurological Disorders

Acceptable Function

- When the envelope of function is WNL.
- Efficient use of the masticatory muscles.
- Absence of TMD symptoms.
- Absence of tooth wear, abfractions, mobility, etc…
- Does not mean that they are in Centric Occlusion.
- When they answer no to the 5 Questions.
Anterior Constriction

- This occurs when the anterior teeth are in the way, (the first point of contact is on the anterior teeth) causing them to hit when chewing, forcing the jaw posterior to CR.
- Tender joints/TMD.
- Tired muscles when speaking a lot.
- Tired muscles with difficulty in nasal breathing.
- Absence of wear on posterior teeth**.
- Typical wear pattern is that of wear on the lingual of maxillary anterior teeth and facial of the mandibular anteriors.
- Possible mobility of anterior teeth with no mobility posteriorly.
- Possible open spaces on anterior teeth.
- Fast chewing cycles.
- Anterior initial contact following deprogramming.

Key Concept: Occlusal Dysfunction

- Most people have occlusal dysfunction to varying degrees but are able to deal with it quite well depending on how prominent the interferences are.
- Iatrogenic changes to the occlusion can exacerbate occlusal dysfunction and create an unstable bite through the removal or alteration of even one occlusal stop.

Occlusal Dysfunction

- Posterior interferences into MIP create avoidance patterns.
- Inefficient use of masticatory muscles- aberrant chewing pattern.
- Characterized by some, any or all of the following:
  - Muscle Hypertrophy- knots
  - Masticatory muscle fatigue
  - Generalized wear facets
  - Wear on incisal edges, maxillary and mandibular teeth- (ask me why)
  - Generalized mobility pattern
  - Avoidance of chewing certain hard, chewy foods
  - TMD
  - Unilateral muscle symptoms more common
  - More than one bite
  - Posterior initial contact following deprogramming

Functional Occlusion?
Occlusal Dysfunction?

Where is the wear?

MIP

MIP
Key Concept: Malocclusion and the Chewing Cycle (and your Smile Makeover)

- Anterior Constriction causes pain upon clenching. Why?
- This causes the chewing cycle to be vertical, short and fast, without the ability to chew strongly on the posterior teeth. They will have trouble chewing something small like gum.
- Occlusal Dysfunction causes the chewing cycle to be erratic and with a much wider pattern as they run into occlusal interferences and their mandible has to work its way around them. Thus they have a tendency to hit anterior teeth during the chewing cycle. Pop or crack goes the veneer…

Parafuction Definition

- Usual oro-facial motor activities include chewing, swallowing, breathing and speaking.
- In dentistry any unusual activity is called para-function, a general term describing NON functional oro-mandibular and lingual activities such as jaw clenching; bruxism (tooth grinding); tooth tapping; cheek, lip or tongue biting; nail biting; tongue thrusting; lip licking; tongue protrusion; gum chewing; object biting; hypersalivation/swallowing; abnormal head posture.
- Para-function may occur while awake or asleep or both.
- Para-function may be voluntary (e.g. gum chewing), be repeated as a habit or tic (e.g. clenching), or be involuntary (e.g. sleep bruxism).
- Patients may have several para-functions.

Glossary of Prosthodontic Terms-8th Edition

Parafunction Causes

- Psycho-social- stress or anxiety
- Reactivity- anger or frustration
- Medical or Drug related conditions- e.g. Parkinson's
- Sleep Parasomnia, REM behavior disorders
- Many others

Key Concept: Restoring Occlusion to Treat Parafunction

Careful. Careful!
**'The dental occlusion as a suspected cause for TMDs**

- In a large epidemiological cross-sectional survey, associations between 15 occlusion-related variables and TMD signs or symptoms were found. However, statistical associations do not prove causality... it is apparent that the evidence of a causal relationship is weak. Symptom improvement after insertion of an oral splint or after occlusal adjustment does not prove an occlusal aetiology either, because the amelioration may be due to the change of the appliance-induced inter-maxillary relationship. In addition, symptoms often abate even in the absence of therapy, it appears more rewarding to focus on non-occlusal features that are known to have a potential for the predisposition, initiation or perpetuation of TMDs.


**True or False?**

- Malocclusion causes bruxism.  
  **False**

- Bruxism can be cured with occlusal therapy or rehabilitation.  
  **False**

**Are Bruxism and Occlusion Causally Related?**

A PubMed search of the English-language literature, using the query 'Bruxism [Major] AND (Dental Occlusion [Major] OR Malocclusion [Major])', yielded 93 articles, of which 46 papers were finally included in the present review*.


**Are Bruxism and Occlusion Causally Related?**

“It was concluded that neither for occlusal interferences nor for factors related to the anatomy of the oro-facial skeleton, is there any evidence available that they are involved in the aetiology of bruxism. Instead, there is a growing awareness of other factors (viz. psychosocial and behavioural ones) being important in the aetiology of bruxism...

Hence, based on this review, it should be concluded that to date, there is no evidence whatsoever for a causal relationship between bruxism and the bite.”

Does Malocclusion cause Bruxism?

The relationship between bruxism, occlusal factors and oral habits.

- A group of 680 students, of both genders, average age 4 - 16 years, were randomly selected. Data was collected by clinical evaluation and questionnaires replied by those responsible for the students. The occlusion morphological aspects were evaluated according to Angle classification and following a criteria created for the deciduous dentition, according to Foster and Hamilton (1969). Uni or bilateral posterior and anterior crossbites were evaluated. 592 questionnaires were fulfilled completely. Bruxism had a prevalence of 43%, whilst 57% presented malocclusion.


Adaptation vs. Bruxism

- Patients with Occlusal Dysfunction or Anterior Constriction will exhibit wear on their teeth and possible TMD symptoms that may be ongoing as an adaptation to their malocclusion.

- This adaptive process is accelerated by psychosocial factors that cause them to tense up and clench. Clenching on a malocclusion can lead to adaptive grinding, and eccentric chewing patterns that tend to destroy dental prostheses.

- Occlusal therapy in conjunction with relaxation techniques can be very helpful for these patients.

- True bruxers and those with neurological disorders will not benefit from occlusal therapy as a treatment for their bruxism. Occlusal splints will help protect their teeth but will not cure the bruxism.

- How can we tell if the patient is a true bruxer?
### The Examination

- Fill out the Ti-Max medical and dental questionnaire with the patient.
- Examine the TMJ and muscles of mastication.
- Check for signs of attrition, abrasion, erosion, recession and wear facets.
- Consider the location of all wear facets - posterior/anterior/lingual.
- Note any missing teeth. Inquire as to how they lost them. Do they miss them?
- Ask them to close. Check the interocclusal spacing where the missing teeth are. Will we need more room? Do we need to open the bite/adjust opposing teeth?

### The Key Questions to ask when you suspect occlusal issues.

1. Do you feel that you clench or grind your teeth?
2. Do you have problems chewing a small piece of gum?
3. Do you have problems chewing bagels (dry chewy food)?
4. Have your teeth changed in the last 5 years?
5. Do you have more than one bite?
6. Do you sleep restlessly?
Understanding The Key Questions

1. Do you feel that you clench or grind your teeth?

Which? Clench or grind?
When? Daytime, nighttime, exercise?
Why? Occlusion? Stress? Both?
For how long?
What system is affected? TMJ, Muscles, Teeth? Combination?
Previous treatment? Appliances.
Have you had orthodontic treatment? Lots of dental work? Trauma?

Understanding The Key Questions

2. Do you have problems chewing a small piece of gum? Suspect a constricted chewing envelope. Why?

3. Do you have problems chewing bagels (dry chewy food)? Suspect a possible occlusal dysfunction. Why?

4. Have your teeth changed in the last 5 years? Ask about increased wear/shorter/thinner/looseness/mobility/open spaces. This indicates that the problem is still active and not adapted.

5. Do you have more than one bite? Suspect possible occlusal dysfunction. Why?

6. Do you sleep restlessly? Restless leg syndrome. Movement disorders-consider parafunction or neurological disorders.

Putting it all together

When do we treat Malocclusions?

- When the patient is symptomatic- TMD
- When we wish to prevent OD from “adaptation” and save bruxers from destruction.
- When we are about to perform extensive restorative work that we do not wish to see destroyed.

i.e. We treat malocclusion when we need to manage the forces on the system

What treatment options exist for treating malocclusions?

**Parafunction:**
- Bruxism: Flat plane NG
- Clenching: Modified Deprogrammer NG

**Occlusal Dysfunction:**
- If caught early, equilibration, and restoration of affected teeth.
- If detected late and VDO lost then FMR or no treatment. (Why not Equilibration?)

**Anterior Constriction:**
- Orthodontics or Posterior Buildup
Q: How do we determine if the patient is exhibiting an adaptation to a treatable malocclusion or if they have parafunction?
A: Exam, Questions and History. Where are the wear facets? What are the symptoms? History.
A true bruxer is hard wired and likely has been parafunctioning for life. They will exhibit tell tale side to side wear facets on a NG. They will break or wear through NG on a regular basis.
Tip: Do not recommend Occlusal reconstruction for a Bruxer as a treatment for bruxism. You may reconstruct lost tooth structures but they will require a NG for life.

Q: Do we recommend occlusal therapy (splints, NG, orthodontics, reconstruction or equilibration) because our examination revealed wear facets in the absence of symptoms?
A: First we examine deeper. It depends on the answers to the questions.
It is possible to prevent a lifetime of wear if we catch the occlusal dysfunction early. The key is whether there is active adaptation.

Patient presents with sore TMJ unilaterally. Has been having headaches and notices that some teeth are more tender and sensitive than normal. This has been occurring off and on for some time.
Why are the TMD symptoms off and on? Have they suddenly developed a malocclusion? Does it spontaneously resolve? Has their bite changed?
Is the Malocclusion the problem or the stress? Should we treat the malocclusion or the stress?
What is the likely malocclusion?
How will you treat them?

Patient has mild to moderate wear facets on posterior teeth. Patient has lost 1.5 mm off the incisal edges of the anteriors. Patient is missing tooth 12 (#7). You are planning a smile makeover with porcelain veneers and a single anterior implant.
Q: Should you proceed?
Q: If yes, then how will you proceed?
Clinical Relevance of Existing Occlusions for Implant Dentistry

• Class II and III occlusions (not malocclusions), crowding, spacing, uneven dental arches, etc. do not require treatment unless the aesthetics are unacceptable to the patient, the occlusion is destructive or unstable, or major treatment is planned.

• The recognition and treatment of such occlusions needs to be part of the treatment planning process when implant therapy is planned.

Clinical Relevance of Malocclusion for Implant Therapy

• If someone has a less than optimal occlusion and you alter their bite with implants you may have a big problem.

• Placing implants into active malocclusions is a recipe for disaster. (Why does my crown keep breaking?)

• Placing a single implant in the anterior of someone undiagnosed with an anterior constriction would be a problem. Constricted bites often require orthodontic tooth repositioning or complete reconstructions. If your implant is in the anterior it could end up in the wrong place if they require orthodontic treatment.

Clinical Relevance of Malocclusion for Implant Therapy

• Placing a single molar implant in an occlusal dysfunction patient may cause prosthetic failures.

• Implants do not function like teeth as they have no suspension (PDL). Therefore undiagnosed parafunction, overlooked dysfunction and constricted envelopes will create large problems such as improperly positioned implants for where the bite should be as opposed to where it is now.

• Additionally implant overload can lead to prosthetic failure and/or implant loss.

Malocclusion as Occlusal Disease

• In the past occlusion was taught as a rigid dogma.

• If we saw a “malocclusion” as defined by Angle then it was considered to be “disease” which required treatment and our goal was to restore the patient to Angle’s Class I in CR.

• Nowadays, unless we have to restore we do not treat malocclusion as a disease in the absence of symptoms.

• As long as their occlusion is functional and we are not planning extensive restorative or orthodontic work then we do not change the occlusal scheme.

• Ask yourself: Where is the wear, the sensitivity, the mobility, the cracks, fractures, pain?
Occlusion & Implants

Mutually Protected Occlusion

- This is the natural set up of a harmonious occlusion where the front teeth overlap
- The overlap causes the posterior teeth to disclude when the mandible moves in any lateral, protrusive or excursive movement
- and the Posterior teeth (VDO) protect the anterior teeth from overload
- This is the goal with natural teeth and with implants

Group Function

- Lateral or excursive movements are not protected by the canines allowing for multiple posterior tooth cusp edges to contact simultaneously
- Lack of Anterior Guidance

Mutually Protected Occlusion
Ideal Occlusion

- Full posterior occlusal stops with equal simultaneous pressure when loading
- Hold shimstock equally on all posterior teeth
- No slides as patient closes fully
- Anterior teeth in contact with light pressure (can just pull shimstock through).
- Anterior Guidance discludes all posterior teeth in excursions.
- Repeatable, predictable, verifiable and reproducible hinge axis.
- MIP=CR. CRO or CO is desired.

Implant Occlusion for the Dentulous

Single Posterior Tooth Implants Protected by Adjacent Teeth

Multiple Implants Protected by Adjacent Teeth- Not Free End

- Teeth compress 10-20µm, whereas a stable implant will compress 2-3µm.  
  Tip: When adjusting the occlusion it is best to use 8µm shimstock that can pull through on the implant(s) when the patient forcefully clenches.
- Ensure there are no lateral excursive contacts. Flatter plane teeth are often used in the posterior.
- When force factors are not ideal consider a smaller bucco-lingual dimension on the crowns to decrease the occlusal load.

Single and Multiple Implants Not Protected by Adjacent Teeth

Unilateral Free End Quadrant

- Teeth compress 10-20µm, whereas a stable implant will compress 2-3µm.
- For unilateral free end cases the occlusal set up is the same as protected except:  
  When adjusting the occlusion the shimstock will pull through on the implant(s) when the patient lightly closes but engages on clenching.
- Ensure there are no lateral excursive contacts- not group function. Flatter plane teeth are often used in the posterior.
- When force factors are not ideal consider a smaller bucco-lingual dimension on the crowns to decrease the occlusal load.
**Multiple Posterior Implants - Bilateral Free End Quadrants**

- Teeth compress 10-20µm, whereas a stable implant will compress 2-3µm.
- For bilateral free end cases the occlusal set up as mutually protected:
  - *When adjusting the occlusion the shimstock will engage on the posterior implants when the patient lightly closes with simultaneous bilateral even contact (no slides) engaging before the anterior segment so that the shim stock will (just) pull through on the anterior dentulous section thus protecting the anterior teeth from overload.*
  - Ensure there are no lateral excursive contacts- not group function. Flatter plane teeth are often used in the posterior.
  - When force factors are not ideal consider a smaller bucco-lingual dimension on the crowns to decrease the occlusal load.

**Single and Multiple Anterior Implants.**

- Canines- Increase concavity on the lingual to allow some room for minor movement when chewing but leave enough for canine guidance to still be in place.
- Lateral Incisors- shorten to allow them to be protected by the Canines and Centrals.
- Central Incisors- Ensure bilateral simultaneous incisal edge contact on both incisors to share the protrusive loads.
  - *When adjusting the occlusion it is best to use 8µm shimstock that can just pull through on the implant(s) when the patient forcefully clenches. Implants do not over erupt.*

**Implant Occlusion for the Edentulous**

**One Arch Implant Supported. e.g. lower implants with a CUD**

- This situation is treated the same way that you would if the implant restoration was natural teeth opposing a denture. The implants will not be overloaded in excursions because the denture will disengage first.
- Posterior group function with bilateral balancing contacts (if possible).
- Flatter curve of spee
- Less anterior guidance
- Flatter plane teeth- 20 degrees or less
- Full posterior occlusal stops with equal simultaneous pressure when loading. No slides. Pull shimstock through on the anteriors.
- Of course in edentulous cases MIP=CR. CRO or CO is desired.
Both Arches Implant Supported Without Posterior Cantilevers.

- This situation is treated the same way that you would if the implant restorations were natural teeth with the exception generally being that the occlusal table is slightly narrower in the posterior to decrease occlusal loading.

Both Arches Implant Supported Without Posterior Cantilevers.

- Full posterior occlusal stops with equal simultaneous pressure when loading
- Hold shimstock equally on all posterior teeth
- No slides as patient closes fully
- Anterior teeth in contact with light pressure (can pull shimstock through).
- Anterior Guidance discludes all posterior teeth in excursions.
- Repeatable, predictable, verifiable and reproducible hinge axis.
- MIP=CR. CRO or CO is desired.

Both Arches Implant Supported With One or Both Having Posterior Cantilevers.

The occlusal scheme is set up exactly as it is for full arch implant supported without cantilevers.
The difference is that the occlusion will be less on the cantilever (shimstock pulls through).

Case Study #1: Tom
Diagnosis?
Treatment Plan?
Case Study #3: Carrie
Thank you!

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