Occlusion, TMD, and Orofacial Pain

Centric Relation
A maxillo-mandibular relationship in which the condyles articulate with the thinnest avascular portion of their respective disks with the complex in the anterior-superior position against the slopes of the articular eminences. This position is independent of tooth contact. 

Centric Occlusion – Where the teeth are when the TMJ is in CR.
The occlusion of opposing teeth when the mandible is in centric relation. This may or may not coincide with maximum intercuspation position.

Maximum intercuspation – The best the teeth can fit together.
The complete intercuspation of the opposing teeth independent of condylar position.

Stamp cusps
Load bearing
Supporting, centric cusps
Maxillary lingual cusps
Mandibular facial cusps

Shearing cusps
Non-load bearing
Guiding, non-centric cusps
Maxillary facial cusps
Mandibular lingual cusps

Laterotrusive Contacts
Working Side Contacts
Contacts of teeth made on the side of the articulation toward which the mandible is moved during working movements

Mediotrusive Contacts
Non-working/Balancing contacts
Contacts of the teeth on the side opposite to the side toward which the mandible moves in articulation

Mandibular Movement
Working/Rotating condyle
Side to which the mandible is moving
Capable of laterotrusion as it rotates

Non-working/Orbiting condyle
Opposite the direction of movement
Moves downward, forward, and inward as the mandible moves in laterally

Protrusive condylar path
Shallower than the lateral CP
Angle between = Fisher’s angle
Protrusive records when used to set condylar inclination will result in posterior cusp heights that are shorter than if a lateral record had been used

Occlusal Schemes: Tooth to Tooth Relationship
Cusp-Marginal Ridge Occlusion
Placement of a cusp in contact with teeth at their marginal ridges
The cusp cannot normally be tripoded for stability

Cusp-Fossa Occlusion
Placement of stamp cusp into a fossa of the opposing dentition.
Stability is gained in the mesio-distal direction by closure stoppers and equalizers and in a bucco-lingual direction.

Cusp to Fossa Occlusion
Advantages:
Forces in line with the long axis of teeth
Eliminates the “plunger cusp” effect
Greater stability to the dental arch
Tripodal Contacts
Each cusp contacts three points on the opposing tooth
Mesial to distal stability = closer stoppers and equalizers
Buccal to lingual stability = A,B, & C contacts

Interocclusal Contacts
A contacts- Shearing cusps of maxillary teeth occlude with stamp cusps of mandibular teeth
B contacts- Stamp cusps of maxillary teeth occlude with stamp cusps of mandibular teeth
C contacts- Stamp cusps of maxillary teeth occlude with shearing cusps of mandibular teeth

Interocclusal Contacts
Closure Stoppers

Equalizers
Closure Stoppers
PURPOSE
Stops closure of mandible as it relates to maxilla

LOCATION
Distal incline of maxillary posterior teeth
Mesial inclines of mandibular posterior teeth

Equalizers
PURPOSE
Equalizes forces exerted by closure stoppers providing mesial-distal stability
Assures facial-lingual stability

LOCATION
Mesial incline of maxillary posterior teeth
Distal inclines of mandibular posterior teeth

Articular Disc
Disc is dense, fibrous connective tissue, not cartilage
Central area is thinner than edges
Biconcave shape is self-centering
Virtually avascular and non-innervated
Not susceptible to pain and inflammation
Disc is minimally adaptable during function

Synovial Fluid
Produced by the joint lining and the retro-discal tissue
Since disc is avascular, provides nutrient transport
Lubricates the articular surfaces
Needs joint movement to move fluids
Prolonged joint loading reduces synovial fluid

Muscles of Mastication
Lateral pterygoid muscle
Inferior and superior head
Inferior head pulls the condyle forward during protrusive/lateral movements,
Superior head contracts during closing to properly position and stabilize the disk and condyle
**Temporalis muscle**
- Positions condyles superiorly during closing
- Acts with superior head of Lateral Pterygoid

**Masseter and Medial Pterygoid muscles** - Contract to seat the condyles superiorly and anteriorly against the articular eminences.

**Occlusal Schemes**

**Balanced Occlusion**
(Bilateral Balanced)

**Group/Shared Function**

**Excursive movements**
- Lateral excursions
  - Working side – contact between as many teeth as possible
  - Non-working side – no contact, no balancing interferences
- Protrusive – anterior teeth disclude the posterior teeth

**Concept**
- Share the load as much as possible,
- Total stress distributed

**Indications**
- Periodontally involved teeth
- Long span FPD
- Implant cases where forces are distributed

**Mutually Protected, Canine Protected**

**Maximum Intercuspatation;**
- Posterior teeth are in contact and protect the anterior teeth
- Anterior teeth are touching very lightly or slightly

**Excursive movements**
- Anterior teeth contact, protect posterior teeth
- Posterior teeth separate and are not in contact, protected by anterior teeth
- Protrusivemovements- incisors disclude posterior teeth
- Lateral excursive movements- working side canine discludes posterior teeth

**Mutual Protection**
- Posterior teeth protect the anterior teeth in centric
- The anterior teeth protect the posterior teeth in eccentric movement
- This mutual protection occurs naturally in the majority of natural occlusions

**Mutually Protected**

**Contraindicated with:**
- Significantly mobile anterior teeth
- Class II occlusion, no contact anteriorly
- Class III occlusion, no contact anteriorly

**Advantages of mutually protected occlusion:**
- Decreases muscle activity
- Eliminates occlusal prematurities
- Decreases wear, posterior teeth not in contact in excursive movements
- Increases stability

**Concept**
- Mandible acts as lever system with the fulcrum at the TMJ.
- The greatest forces can be generated nearest the fulcrum- posterior teeth.
- More damaging horizontal forces of eccentric movements should be directed to the anterior teeth, from the
fulcrum.
The canines have the largest and longest root.
For protrusive movements, central incisors disocclude the posterior teeth, furthest away from the fulcrum and subject to less forces.

**Restore a patient in CR or MIP?**

**Maximum Intercuspation**
- For Single Crowns and FPDs.
- Not altering the vertical dimension of occlusion.
- In patients with occlusal harmony restore in MIP. If the occlusion and masticatory systems are functioning successfully with no signs of damage or discomfort, the patient has a physiologically acceptable occlusion. It is within the body’s envelope of adaptability.

**Centric Relation**
- When extensive restorative work
- Opening vertical dimension of occlusion indicated
- CR is the most stable position for the condyles and may, in some people, allow the least possibility for the development of pathological conditions.

**Orofacial Pain (OFP)**
- **OFP Incidence**
  - 7% of population (13 million)
  - 50% untreated

- **OFP Impact**
  - 75,000,000 lost workdays/yr

Typical Patient- There is no typical patient
- Most often: Females 25-45 YO
- BUT CAN BE ANYONE

**TMD**
- Tension headache
- Migraine headache
- Referred pain- tooth
- Cluster headache
- Sinus congestion
- Neuralgia
- Referred pain
- Herpes zoster
- Post-herpetic neuralgia
- Aneurysm
- Tumor
- Infections
- Trauma

**Signs and symptoms of bruxism**
- Dull, constant pain of long duration
- Abnormal tooth wear
- Difficulty in maximum opening
- Intensity of pain is greater in AM and decreases as day progresses
- No associated increase in thermal sensitivity

**Masticatory System - Functions**
- Speech
- Swallowing
Mastication
   Chewing stroke
   Tooth contacts
   Forces of Mastication
      Males (53.6-64.4 kg) bite with more force than females (35.8-44.9 kg)
      First molar several times higher than that applied to an incisor
      Varies greatly from individual to individual; increases with age

Causes of Functional Disturbances - TMD
   Predisposing Factors – Increase the risk of TMD
   Initiating Factors – cause the onset of TMD
   Perpetuating Factors – interfere with healing or enhance the progression of TMD
      Occlusion
      Trauma
      Emotional Stress
      Deep Pain Input
      Parafunctional Activities

Causes of Functional Disturbances - TMD
   Occlusion
      At one time occlusion was considered to be the most important contributing factor
      Most agree that occlusal prematurities play little to no role in TMD
      There may be two occlusal factors:
         Sudden acute change (high restoration)
         Occlusal instability
      TMD can cause malocclusion; malocclusion does not cause TMD
      Irreversible occlusal treatments are not indicated for TMD treatment

Causes of Functional Disturbances - TMD
   Trauma
      Greater effect on capsular disorders than muscular disorders
      Macrotrauma - sudden force that can result in structural alterations (blow to the face)
      Microtrauma – small force repeatedly applied over a long period of time (bruxism, clenching)

Emotional Stress
   Can have an influence on muscle function
   Can increase levels of nonfunctional muscle activity
   Can result in sympathetic nervous system activity leading to increased muscle tone
   Can reduce physiologic tolerance

Deep Pain Input
   Can centrally excite brainstem, producing a muscle response known as protective co-contraction
   May confuse limited mouth opening as primary TMD problem rather than a secondary response

Causes of Functional Disturbances - TMD
   Parafunctional Activities
      Bruxing, clenching, oral habits
      Diurnal – parafunctional activity occurring during the day
      Most parafunctional activities occur at a subconscious level
      Best treatment strategy may be to make patient aware of the possibility of activities

Causes of Functional Disturbances - TMD
   Nocturnal – evening parafunctional activity
      Quite common, clenching and rhythmic contractions, bruxing
      Force of tooth contacts exceeds that associated with normal functional activity
      Parafunctional activity results in horizontal forces (not well tolerated)
      During parafunctional activities, the neuromuscular protecting mechanisms appear to be somewhat obtunded.
Causes of bruxism
   Emotional stress
   Medications (SSRI’s)
   Common in children- just happens, no indication of pathology
   Not associated with occlusal interferences

Diagnosis
   “TMJ” and “TMJ syndrome” are not a diagnosis
   Patients may have multiple diagnoses
   Look for joint and muscle problems
   Guidelines:
   Muscle: steady ache, band of pain
   Joint: TMJ ache, localized preauricular
   Neuropathic: burning, shooting, electric, paresthesia
   Sympathetic: burning, hyperesthesia
   Neurovascular: throbbing
   Psychological: descriptive, pain as punishment

Classification/Diagnosis of TMD:
Interrelationship of TMD
Disc Derangement Disorders
   Articular disc displacement is the most common
   Abnormal relationship or misalignment of the disc and condyle
   Possibly caused by stretched or torn ligaments
   **Disc displacement with reduction**
   Disc is usually anterior

   “Pops” / “Clicks”

   May have pain with noise

   Reciprocal click
   **Disc displacement without reduction**
   Disc is usually anterior
   History of sudden limited opening
   Closed lock
   Does NOT “Pop” or “Click”
   May have pain on opening
   Muscle guarding or locked

   Usually affects only one condyle
   Disc is anterior (usually)
   Does NOT “Pop” or “Click”
   Closed lock - sudden limited opening
   Range of opening is usually limited
   Deviation of mandible towards affected condyle
   If reduction occurs, condyle may snap back to a more central location
   Clicking/popping may be heard. Opening click occurs at a wider opening than closing click
   May have pain on opening

Treatment Options for TMD
   **Self care instructions**
   **Occlusal appliances**
Medications
Physical therapy
Behavioral therapies
TMJ surgery
Self Care Instructions
All patients
Education (Physical Self-Regulation)
- Muscle relaxation training - Patients taught to keep all muscles relaxed, especially facial muscles
- Posture
- Jaw stretch
- Diagonal flexion
Reassurance
Patient responsibility

Goal - reduce pain, improve awareness
How:
- Stabilize the joints
- Reduce muscle strain
- Muscle relaxation
- Occlusal balance
- Reduce negative behaviors
Indications:
- Nocturnal clenching with pain
- Reproducible jaw pain from diurnal behaviors
- Reproducible jaw pain with signs of behaviors
- To “de-program” when trying to find CR
Flat plane appliances
- 70 to 90% of all appliances
- Maxillary vs Mandibular

Myths
Myth: Splints stop the patient from clenching/bruxing
Fact: A splint does NOT stop diurnal or nocturnal parafunction. In the day it is a “reminder” and at night it reduces the detrimental effect of the activity

Myth: Splints cure “TMJ”/“TMD”
Fact: Splints do not cure anything as they do NOT address the cause. Splints are NOT a panacea (cure-all)

Myth: A splint is the only needed treatment for “TMJ”/“TMD”
Fact: The splint, if used at all, is not the focus of a treatment plan, but rather a supporting member

Myth: Splints need to only cover a few anterior teeth (segmental) to reduce muscle tension
Fact: Splints MUST cover all teeth or undesired tooth movement may occur DO NOT BE PERSUADED TO MAKE SEGMENTAL APPLIANCES

Pharmacotherapeutics
Orofacial pain - no magic and no quick fixes
Patient responsibility = 90%
Splints and drugs - palliative only - mask the etiology
Commonly used meds:
- Analgesics
- Anti-inflammatory agents
- Antidepressants
- Muscle relaxants
- Benzodiazepines
- Anti-epileptic drugs (AEDs)
- IM & Intra-TMJ injections
- Topical analgesic agents

Physical Therapy

Patient Modalities
- Superficial heat
- Cryotherapy (cold treatment)
- Microamperage electrical neuromuscular stimulation (MENS)
- Transcutaneous electrical nerve stimulation (TENS)
- Electrogalvanic stimulation (EGS)
- Ultrasound (US)
- Iontophoresis

Adjunct to measures addressing etiology
- Behavior alterations, exercises, reduce caffeine, etc.

Therapeutic exercises
- Indicated to address generalized muscle pain
- Improve ROM
- Reduce signs and symptoms
  - TMJ noise
  - Muscle pain
  - Referred pains
  - Perceived ear pain

Primary occlusal trauma
- No inflammation (no disease)
- Greater than normal occlusal force
- “High” restorations, orthodontic movement
- Tissue levels not affected; pockets not formed
- Hemorrhage and thrombosis of Blood Vessels in PDL

Secondary occlusal trauma
- Inflammation (disease) MUST be present
- Normal (or greater than normal) occlusal forces

Responses to occlusal trauma

Injury stage
- Pressure leads to widening of ligament space and resorption
- Tension leads to widening of ligament space and apposition

Repair stage
- New tissues are formed (Connective Tissue, PDL, bone, etc…)

Adaptive remodeling stage
- Occurs if repair cannot outpace destruction
  - Thickened PDL
  - Angular bone loss
  - Mobility of involved teeth
  - Increased local vascularization

Behavioral Therapies
- Psych presentation should not deter from appropriate physical evaluation
- Chronic pain concomitant issues: depression, anxiety, fear, frustration
- Do not assume these are the causes
- Poly-pharmacy
- Dentists: DO NOT attempt to make or record a psychiatric diagnosis

Orofacial pain assessment
Behavioral Therapies
Behavioral assessment
Psychological evaluation
Stress
Psychological management
If possible, address psychological issues prior to therapy
Therapist will assist the patient - “frame of mind” ready/able to accept treatment
A depressed patient may not be capable of performing self-care / muscle
Sleep disturbances
Biofeedback

TMJ Surgery
Lack of compliance is NOT an indication for surgery
Decision to pursue surgical therapy should be based on the following
- Severity of pathology
- Potential for repair
- Degree of dysfunction
- Nonsurgical outcomes
- Patient expectations

TMJ Surgery
Presurgical guidelines:
- Documented TMJ internal derangement or other structural disorder with appropriate imaging
- Positive evidence to suggest that symptoms/objective findings are a result of structural disorder
- Pain and/or dysfunction of such magnitude as to constitute a disability to the patient

**PRIOR UNSUCCESSFUL NONSURGICAL TREATMENT**
Prior management (to the extent possible) of bruxism, oral parafunctional habits, concurrent active dental problems and other contributing factors that may affect the surgical outcomes
Patient consent after a discussion of potential complications, goals, success rate, timing, postoperative management and alternative approaches including no treatment

Sleep Disorders
Sleep deprivation is a growing problem
- 20% higher now than in previous generations
- 7-8 hours per night is considered the norm
- Continuous less than 6 hours per night leads to significant degradation of function

Insomnia
It is not the not simply the number of hours of sleep; it is the quality of sleep
- Difficulty falling asleep
- Difficulty staying asleep

**Insomnia**
- 28% of adults admit to missing work or making mistakes due to sleep deprivation.
- Many are too tired to realize they are sleep deprived.

Symptoms of Sleep Disorders
- Insomnia
- Sleep Apnea
- Narcolepsy
- Restless Leg Syndrome
- Bruxism

Causes of Snoring
- Obesity
- Blocked airway

Anatomic conditions
- Class 2
- Class 3
Open bites

Sleep Behavior Treatments
Drugs- Ambien, Lunesta, benzodiazepines, Melatonin
Nocturnal Bruxism- Mouth guard, decrease stimulants, EtOH
Behavior modifications- Surgery, Dental Devices, Weight Loss

Bottom Line
Modify behaviors
Protect the dentition
Help patient adapt and overcome
Do not overstep boundaries of training, competencies and local statutes.
Refer to other medical professionals- Team Approach!

References:
Okeson, Jeffrey P, Management of Temporomandibular Disorders and Occlusion
American Academy of Orofacial Pain
ABGD Review Handout (Drs Christopher Minke, Marcus McDonald, and Gary Braun)
Col Maureen Lang (AF/SG Consultant for Orofacial Pain)
LtCol Allan Parke (Chief of Prosthodontics -Barksdale AFB AEGD-1)