The ABC’s of TMD’s
Barry Glassman, DMD

From Tooth Wear to Migraine
— Controlling the Damaging Forces of Parafunction that Threaten Everyday Dentistry
Cincinnati Dental Society
April 4, 2009

Houston,
We have a problem
TMD Concepts

• “I don’t treat TMD.”

THE “TMD” Patient

Perio patient?
Crown patient?

TMJ? Is “TMD” any better?

• Unfortunately, because a validated classification system had not been available for a long time, TMD became a commitment-free term frequently used by clinicians and researchers to avoid well-defined differential diagnoses. This resulted in poorly defined diagnostic criteria for clinical research and, in many cases, indiscriminate treatment.

How did this happen?

• Odontogenic Pain ..... Non Odontogenic Causes

  - Joint position emphasis Guichet then Gelb
  - Muscle emphasis NM Jankelson
  - Holistic and/or Structural emphasis
Out of the BOX OF DENTISTRY

Dental Resistance
Box of Dentistry
Dental Interphase

Muscles ignored
Joint ignored
Ligaments and insertions ignored

Trigeminal Nerve Ignored

The Box of Dentistry

• Jump out of ONE BOX (The Mystique of Occlusion) and INTO ANOTHER
  - Joint
  - Muscle
  - Structure
  - Holistic
Happy Muscles

- The Use of TENS in the NM concepts
- Recent Interview in Dentistry Today compares instrumentation (using EMG’s) to and EKG
- Claim of Parafunctional Control with mandibular posture
  
  Happy Muscle = No parafunction
  
  THEREFORE

  Unhappy muscles = Parafunction
Muscle and Holistic Leaps of Faith

- Happy muscles make happy people

“I make happy smiles and eliminate headache and neck pain”

sEMG as a Diagnostic Tool vs. a Note of Interest

Structure

- Correction of asymmetry resolves “pain” and improves function
- Therefore
  - Assymetry = pain
  - Assymetry = dysfunction

Are we symmetrical beings? How symmetrical?
Introduction to Adaptive Capacity and goals

• Leaps of faith from dental procedures and responses
• Leaps of faith as to causal relationships based on symptomatic reports
• Pain vs. restorative concepts

Goal in Pain Management: Crime/Punishment

Need to Develop Model for Dentistry

Diagnostically Driven
Based on Sound Science
Risk/Benefit Quotient Key Factor

Nature of Chronic Disorders
Concept of Management
Key of History and Listening
Patient Part of Treatment Team
Need to develop model for general dentistry that includes entire CM system

- End of Controversy Requires Some Agreement
  - Model Must be Diagnostically Driven
  - Model Requires Basic Concepts Generally Accepted and Taught
  - Model Must Be Practical and Evidenced Based

Dagnostically Driven Therapy
Model for General Dentistry

- Ask basic questions about headache, joint pain and function and sleep
- Those questions lead to further diagnosis
- Document Diagnosis and Treatment
- Evaluate and refer patients appropriately
- **Parafunctional Control**
  - Sleep position
  - Nutritional supplementation esp for DJD
  - Basic Quality Dentistry
  - Reevaluate and consider supportive therapy
  - Refer appropriately
Medical Update Questions

• Joint Dysfunction
  - Are you aware of joint sounds?
  - Did you ever have joint sounds?
  - Do you ever have pain or soreness in front of your ears?
  - Do you have ear pain?
  - Do you wake up with your jaws sore or tired?
  - Do you ever have difficulty opening widely?
  - Do you avoid eating certain foods because of pain or discomfort?

• Headache
  - Do you get headaches? How often?
  - Has there been a change in your headache pattern?
  - Does anything trigger your headaches?
  - To what degree would you say your headaches effect your life?
  - On a scale from one to ten, what is the range of your headaches?
  - Have you been treated or evaluated for your headaches?
Medical Update Questions

• Sleep
  - Do you snore?
  - Do you have high blood pressure?
  - Has anyone reported that you choke or gasp for air while sleeping?
  - What is your neck size? (inches)
  - Do you wake refreshed?
  - Are you excessively tired during the day?

TMD..

...............for the rest of us
Symptomatic changes without structural alteration

Dr. Tanner……

- Positive Occlusal Sense...

“Fix my bite”
Structural Imbalances

- Facial asymmetry
- Canted anatomy

Positive diagnostic testing vs. Note of Interest

Occlusal Leaps of Faith

- Cross bite
- Angle’s classification
- Micrognathia
- Anterior/Posterior Open Bites
- Interferences to CR

BUT...when I equilibrated my patient got better!

Positive diagnostic testing vs. Note of Interest
Joint Position Leaps of Faith

• Assignment of symptoms to joint position

Function and joint position

But.....when I put the joint in the right place the patient got better!

Mandibular Repositioning is a Commitment

Something to go home with...

TMD for the general dentist

Learning curve
Craniofacial orthopedics
Mandibular repositioning

Mental Disconnect between Occlusion and Pain
Special Thanks to BioRESEARCH

Special Thanks

- Dr. Dennis Murphy
- Ms. Vicki Nixon
Overall Course Goal

- **THINK**
- **Understand**
- **Implement**

Dental Truths………or myths upsetting or enlightening?

- Pure rotation? Why does it matter?
- Tooth function in mastication
- Mastication vs Parafuction
- Working side? Balancing side? WHEN?
  - Canine Rise....WHEN?
  - Anterior Guidance...WHEN? WHY?
  - Anterior Open Bite..........................oops
- “How does that feel?” WHEN?
- “Do you grind or clench your teeth?”
- Angles Classification -- Pathology?
- Interferences to CR or CO vs. Resistance to Movement: The same? Degree of Nociception?
Which muscles are involved in the active elevation?

Did you remember to include the elevating musculature of the mandible?

An elevated mandible has no unusual look to it, and is accepted a presentation of normal...

...even though it is a parafunctional act.
MIP

Do we reach MIP in Canine Guidance Used in Function?

ENHANCED DEPROGRAMMER CONCEPT

Canines

• Anterior Teeth: Esthetics
• Posterior Teeth: Function

Hold This For Concept: Parafunction
Goals

Review Practical Anatomy
Develop a Model for General Dentistry that practically includes the TMJ’s and all facets of the craniomandibular system
Understand the concept of Diagnostically Driven Therapy
Understand function vs. parafunction
Understand the role of ligament insertion injuries
Understand the concept of trigeminally mediated disorders - TMD
Understand the basis of Migraine physiology, diagnosis and treatment

Introduce Dental Sleep Medicine

Confusion and Controversy

The confusion and controversy of TMD

Darkness = Restriction
Enlightenment = Liberation
An Overview of TMD

Diagnosis and Treatment of Trigeminally Mediated Disorders

THE MIND IS LIKE A PARACHUTE

It only works when open
<table>
<thead>
<tr>
<th>TMJ</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>• Is it a syndrome?</td>
<td>• Is it associated with neck pain, facial</td>
</tr>
<tr>
<td>• Is it a progressive functional</td>
<td>pain, shoulder pain, and headaches?</td>
</tr>
<tr>
<td>disorder?</td>
<td>• Is it hormonal, structural, or neural?</td>
</tr>
<tr>
<td>• Is it a degenerative disease?</td>
<td>• Is it the result of parafunctional</td>
</tr>
<tr>
<td>• Is it a psycho-social disease</td>
<td>activity?</td>
</tr>
</tbody>
</table>

Do you have knee?

*The temporomandibular joint is a vital joint of the body. It is not a disease.*
It is better to over diagnose than to over treat

- Diagnosis is the key to treatment
- Patients have specific disorders which require specific diagnosis which leads the practitioner to specific treatment
- Cook book diagnosis and cook book treatments have led to misunderstandings, mistrust, and mistreatment

Peer Reviewed “TMD Studies”
TMD Often Not well Defined

TMD = Trigeminally Mediated Dysfunction
Oh My…….TMD pain

- STATEMENT OF PROBLEM: Bruxism is purported to be a risk factor for temporomandibular disorder (TMD) pain, but the association requires clarification.

PURPOSE: The purpose of this study was to investigate the relation between anterior tooth wear as an indicator for bruxism and the presence of TMD pain.

CONCLUSION: Using anterior tooth wear as an indicator for long-term bruxing behavior, a clinically relevant dose-response relationship between this type of bruxism and TMD pain does not appear to exist.

Oh My…….TMD pain

- TMD Defined:

  - Temporomandibular disorder was defined as self-reported pain in the face, jaw muscles, and/ or temporomandibular joint (TMJ) during the last month, according to either the German version of the Research Diagnostic Criteria for Temporomandibular Disorders or the response to a question about pain in the masticatory muscles or the TMJ according to the Helkimo-Index.
Diagnostically Driven Treatment

“Without diagnosis there is no treatment”

Hippocrates

An Understanding of TMD is Essential

- Symptoms are often triggered with dental procedures
- Patients will often visit their dentist first with symptoms and complaints
- TMD symptoms can mimic dental pathology
- Patients will often ask questions about joint dysfunction
- Having a basic understanding will allow the general dentist to appropriately treat and refer
- Restorative and occlusal therapy requires a basic knowledge of joint and muscular function
Basic Concepts
Some departure from long standing dental principles

- Can’t infringe on freeway space; freeway space is unalterable
- Denture patients should be built into “centric relation” because it is “reproducible”
- A dentist’s realm intra-oral
- Mandibular orthopedic repositioning appliances cause molar intrusion
- The panorex is a useful tool in TMJ diagnosis
- Most TMD patients are women because they don’t work and have time to worry about their health, and run to doctor’s more readily than men
- TMD is a self limited psychosocial disease
- If a patient opens 35 to 40 mm that is to be considered normal
- **Teeth need to be protected when a wear pattern from bruxism is observed**

Review of Structures of Craniomandibular Structures

- Muscles
- Ligaments
- Joints
- Bone
- Teeth

Function vs. Parafunction
Adaptive Capacity

What DRIVES Parafunction?
Parafunction
Adaptive Capacity
What Would This Patient Look Like?
How would he feel?

Function vs Parafunction

Dental function is a small pipe.
Dental parafunction is a large pipe.
Continuum of Health

- Optimum health and fitness
- Good Function
- No symptoms
- Minor symptoms
- Moderate symptoms
- Moderate dysfunction or pathology
- Death

OCCUSION VS OCCLUDING

- OCCLUSION - NOUN
- OCCLUDING - VERB

DR. TANNER: What we do with what we have is more important than what we have

Occlusal Wars?
DENTAL WARS

Occlusion Principles
OR
Parafunctional Control Principles?

- Canine Rise; Discussion Time
- Interferences: Occlusion Time
- Anterior Guidance

• WHEN?
Then they were NOT in CR. Sorry, but if you are not comfortable you are not in CR. That is diagnostic. I don’t just ask. I prod. After occlusal treatment of any kind, I ask every patient to close and clench as hard as they can. I ask them to grit their teeth and grind in all directions. If they can elicit any sign of discomfort, I know I’m not finished because when I have complete harmony with CR, it is impossible for the patient to feel discomfort in the joint. It is a load bearing joint and when it is properly aligned with its disk and fully seated (so all forces go through avascular non-innervated structures, and it’s not braced down the eminence by muscle) there are no nerves or blood vessels to compress or muscles to stretch. The lateral pterygoid stays passive (peaceful) even during maximal clench. All teeth are contacting simultaneously with equal intensity. This equals comfort. It is achievable and predictable by anyone who is willing to learn the principles.
EMG Comparison #1

EMG Comparison #2
EMG Comparison #3
(Four Leads Only)

EMG Comparison #4
Note Proprioception Effect
Trigeminal Ganglion Changes with occlusal trauma in rat

- Zhu M.L, et al,

- The stimulation of occlusal trauma upregulates expressions of PN(3) and MRNA and NaN mRNA, indicating changes in sodium channels in the trigeminal ganglion during orofacial pain induced by introducing occlusal interferences and causing excessive “trauma”

- Is function or parafunction more likely to cause occlusal trauma?
Is function or parafunction more likely to cause occlusal trauma?

- Teeth
- Bone
- Ligaments
- Muscle
- Joints
- Trigeminal activation: altered ability to modulate through sympathetic fibers

Normal Resting EMG’s
Electrognathological Sweep to Evaluate Swallow

Dental Contact for .6 Seconds In The Swallow
EGN Sweep

- Used to measure freeway space
- Note if teeth indeed make contact during the swallow
- Note time teeth are in contact during the swallow

Muscle in Function

- Swallow
  - Note muscle activity in terms of duration
    Compare that to duration of tooth contact
  - Note muscle activity in terms of microvoltage
EMG’s During Three Separate Swallows

- Note rhythmic activity of elevators and depressors
- Note higher microvoltage on working side
- Relative microvoltage as compared to the swallow (approximately the same)
- Note length of muscle bursts (next slide)

EMG In Function: Mastication
EMG During Gum Chewing LEFT

AT Activates slightly before Masseter

Duration of Muscle Burst .32 Sec
Clench with Enhanced Midpoint Stop
(B Splint or NTI)
Muscle Activity in Parafuction: Clench

- Duration not a factor
- Compare microvoltage to function

<table>
<thead>
<tr>
<th></th>
<th>Rest</th>
<th>Swallow</th>
<th>Chew Left</th>
<th>Clench</th>
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</thead>
<tbody>
<tr>
<td>TA – R</td>
<td>1.5</td>
<td>23.2</td>
<td>15.8</td>
<td>149.1</td>
</tr>
<tr>
<td>TA – L</td>
<td>1.9</td>
<td>20.3</td>
<td>28.8</td>
<td>120.5</td>
</tr>
<tr>
<td>MM – R</td>
<td>0.9</td>
<td>21.3</td>
<td>8.9</td>
<td>131.0</td>
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<tr>
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Demonstration of Ligament Trigger
- Muscles at Rest
- Patient Gently Closes
- Slight Tooth Contact
- Reach Threshold

Parafunational vs Functional Forces
“Ligament Trigger” Demonstration
- Evaluating Forces During the functions of swallowing and chewing
- Evaluating Forces of Clenching
- Demonstrate “resistance” concept to elevator muscular burst
- Evaluate effect of anterior midpoint stop on MVC
Nocturnal Bruxism

- Has previously been reported to be present in 15 to 20% of population
  - Suspect it is much higher
  - Difficulty quantifying bruxism
- Higher incidence in sleep apnea patients
- No genetic or gender preponderance
- Rhythmic muscular contraction
Dental Wear Patterns

Would you ask this patient if they clench or grind their teeth?
Nocturnal Bruxism

- Bruxism tends to occur in Stages 1 & 2 and REM sleep but can occur any time
  - We’ve noted arousals and elevated heart rate associated with bruxism!
    - Consider, then, the potential importance of parafunctional control
- Cause: Unknown
  - Shown not to be related to occlusion
  - May be related to airway
  - May be related to stress
  - Effects condylar, dental, and muscular health

Bruxism

- Up to 65% of the patients who brux reported headaches
- Link with stress supported with elevated levels of catecholamines in urine
Lavigne, et al

- Lack of evidence for occlusal management of initiating factors of bruxism
- Tooth contact has been suggested to occur 17.5 min over a 24 hour period (varies of course with presence and frequency of bruxism)

- Bruxism may be linked to multiple genetic factors or to a familial learned behavior

Splint Therapy

Basic Concepts

- Deprogrammer and NTI Concept for Bruxism
  - Proprioception
  - Less effective lever
  - Elevators triggered to activity by molar contact

- Construction of Deprogrammer
  - Accurate impressions
  - Bite Registration (2 mm posterior open bite)
  - Report degree of protrusion

MAJOR ADVANTAGE OF APPLIANCE WITH INCISAL CONTACT ONLY

Discussion of Insertion
Discussion of bruxism and dental appliances
Parafunctional Control Protocol:

During parafunctional occluding events:

1. **MINIMIZE** contraction intensity of the elevators
   - Incisor edge contact only, in all excursions / positions.

2. **OPTIMIZE** condylar position
   - Allow for minimal translation / rotation; i.e., minimal VD of Occluding

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<tr>
<td>Condylar position:</td>
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</tr>
<tr>
<td>Minimally translated during most forceful elevator contractions</td>
<td>Pathologic degrees of translation and/or rotation during forceful elevator contractions</td>
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To **IMPROVE** function, you must **CONTROL PARAFUNCTION**

"Functional Occlusion" is really occlusal design to withstand Parafinction.

Function vs. Parafuction

Chronic parafunction alters the occluding design and modifies functional ability.

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To **IMPROVE** function, you must **CONTROL PARAFUNCTION**
Mandibular Default
Daytime Parafunctional Control
MAPA
ORTHO B SPLINT CONCEPT
TMD Review

Diagnosis is the Key

Comprehensive History
Comprehensive Clinical Exam
J o i n t V i b r a t i o n A n a l y s i s
E l e c t r o g n a t h o g r a p h y
R a d i o g r a p h i c E v a l u a t i o n
M R I

Goal: A Specific Diagnosis That Dictates a Plan of Treatment and a Prognosis
Recent Dentaltown Posting

• How would you tx plan this pt.?

31 yr old male with hx of transient pain in right TMJ. CR records indicate interferences on #2,7,8,9,10(23). Mand. deviates considerably to left on closure to MI from CR (as seen on MI photo). Protrusive photo reveals slight deviation to pt's right. Perio eval reveals chronic mod generalized bone loss, no mobility greater than class I. PD's of note are #2,7,8,9,10 and 23.
The following was taken directly from this thread

1. Perio cleanup, listen to joint sounds with stethoscope while taking TMJ Hx, if symptomatic & patient desires help for this, measure arch widths at molars, & if rest of ortho eval indicates, expand upper arch with fixed Williams appliance ( @ same time with brackets & light wire to start rotating & aligning teeth ), soon thereafter place brackets & wire on lowers to rotate & align < keep checking occlusion & adjust interferences as they occur >- also fit NTI, relined with soft liner material so it can be refitted as ortho Tx progresses. If there are proximal caries that would be covered by molar bands, these would of course be addressed prior to banding. Other caries would be Txed as we go.
C'mon this is easy... you guys are making this too complicated. Just prep the teeth, take a triple tray bite and have the lab open the pin up to about the right place!

3. I would make him an anterior appliance on the order of a Lucia jig for night time wear. Let him wear it for a month to see if the symptoms resolve. If they do the patient will notice that his teeth will not mesh and he has to find his acquired occlusion to get them together. After a month of having the patient wear the appliance at night or during times of stress I would take models and mount them with a face-bow on a semi-adjustable articulator using a centric related bite. This along with the x-rays will help you to plan an appropriate plan for the patient. In all my years of practice I have found that this problem is mostly of neuromuscular origin. The joint can be involved, but I believe that more then 90% of these problems can be resolved by occlusal correction having the anterior teeth protect the posterior teeth in all excentric movements.
Dentaltown Posting

1. Ortho to correct bite and close some spaces.
2. Veneers on 6-11 and 23-26; bridgework on 28-30.
3. NTI

Occlusion and TMD
THE ROLE OF THE DENTAL INTERPHASE

• Critical Information - WHY?
  • There are PATIENTS whom we can help and they don't know it.
  • There are PATIENTS who need our help and can't find it.
    Some are angry; some are tired and have lost hope
Occlusion and TMD

• Patients whom we can help and don’t know it.
  - Patients with chronic joint dysfunction and/or degenerative joint disease
  - Patients with migraine headaches
  - Patients with chronic daily headache
  - Patients with chronic upper quarter muscular dysfunctions and associated pain patterns
  - Patients with sleep disturbed breathing
  - Patients with undiagnosed ear stuffiness and pain
  - Patients whose bruxism is beyond their physical adaptive capacity

Occlusion and TMD

• There are PATIENTS who need our help and can’t find it.

• What Number Are You on their “Second Opinion” list?

Some have truly developed a Positive Occlusal Sense

Some are angry; some are tired and have lost hope

A Sense of Hopelessness is a noted trait that decreases the likelihood of success of treatment at a greater rate than any other factor
Occlusal Wars

• The Lack of Understanding Has Led to Patient Suffering
  - Cook book Diagnosis
  - Assumptions that any one treatment or treatment position is appropriate in every case
  - Justifying positions with biased and flawed studies
  - Looking for success in one’s treatment rather than evaluating failures
  - All this and more has led to………..

Occlusal Wars

• Gnathology vs Joint Position
• CR vs. 4/7
• NM vs. CR
• CR vs CR
• Occlusion vs. Disclusion

Is the following a result of the above?
Model for General Dentistry

- Ask basic questions about headache, joint pain and function and sleep
- Those questions lead to further diagnosis
- Document Diagnosis and Treatment
- Evaluate and refer patients appropriately

- **Parafunctional Control**
  - Sleep position
  - Nutritional supplementation esp for DJD
  - Basic Quality Dentistry
  - Reevaluate and consider supportive therapy
  - Refer appropriately

Diagnostically Driven Therapy

What other type of therapy is there?

Because the “truth” is that no one concept has proven successful for all our patients, despite what the well learned, well respected and well intended guru of the concept teaches
Diagnosis is the Key

DATA COLLECTION

Comprehensive History
Comprehensive Clinical Exam
Electromyography
Joint Vibration Analysis
Electognathology
Radiographic Evaluation
MRI

How did it get that way?
How does it stay that way?

Goal: A Specific Diagnosis
That Dictates a Plan of Treatment
and a Prognosis

MEDICAL MODEL

Diagnose Thoroughly
As un-invasive and thorough as possible
Testing only as deemed required in history

Devise Plan of Treatment
Can be in phases dependent on response to therapy
Goal remains to be as effective as possible as un-invasively as possible
Understand the Possible Commitment of Mandibular Repositioning

Include the Patient in the “Treatment Team”

Monitor Symptoms and Revise Treatment Accordingly

Continue to Treat As Conservatively as Possible When Considering the Need for Dental Stabilization in Terms of Repositioning
Our Model
Key: Intra vs. Extra Capsular

- Initial History
  - Phone Contact
  - History and Symptom Forms

- Comprehensive History

- Initial Oral Exam with ROM

- JVA Screening: JVA/JT Screen

- Radiographic Evaluation

- Comprehensive Examination

- Additional Imaging and Referrals for additional Diagnostic Testing

- Assessment and Developing Plan of Treatment

How did it get that way?

How does it stay that way?

Our Model

- To Diagnose
  - Effectively
  - Accurately

- To Treat
  - Effectively
  - Conservatively "The Least We Need to Do....."
    Does the Punishment Fit The Crime?
  - Reversibly When Possible

- To Constantly Re-evaluate and Consider Phase II vs. Maintenance
  - When is Phase II Required?
  - Verbal and Non-Verbal Messages to Patients
Comprehensive History

- Importance of the first appointment interview
- The medical interview has three functions
  - Information gathering
  - Development of a therapeutic relationship
  - Communicate information and implement a treatment plan
- Features of a good interview
  - natural
  - clinical environment
  - eye contact and body posture
  - body proximity
  - validation of self and complaints
  - facial expression
  - appropriate contact
The Comprehensive History

• Medical and Dental and Social History
• Current symptoms in full detail
• Initial symptoms and history in full detail
• Details of onset
• Sleeping habits
• Ergonomics
• Effect of symptoms on life

The Four Agreements

Toltec Wisdom
Don Miguel Ruiz
Bringing Ancient Wisdom to Contemporary Life

The Four Agreements

Based on ancient Toltec wisdom, the Four Agreements offer a powerful code of conduct that can rapidly transform our lives and our work into a new experience of effectiveness, balance and self-supporting behavior.

Everything we do is based on agreements we have made. In these agreements we tell ourselves who we are, what everyone else is, how to act, what is possible and what is impossible. What we have agreed to believe creates what we experience. When these agreements come from fear obstacles develop keeping us from realizing our greatest potential.

BE IMPECCABLE WITH YOUR WORD

Speak with integrity. Say only what you mean. Avoid using the word to speak against yourself or to gossip about others. Use the power of your word in the direction of truth and love.

KEEP YOUR WORD
DON'T TAKE ANYTHING PERSONALLY

• Nothing others do is because of you. What others say and do is a projection of their own reality, their own dream. When you are immune to the opinions and actions of others, you won't be the victim of needless suffering.

• TAKE NOTHING PERSONALLY

DON'T MAKE ASSUMPTIONS

• Find the courage to ask questions and to express what you really want. Communicate with others as clearly as you can to avoid misunderstandings, sadness, and drama. With just this one agreement, you can completely transform your life.

• DETACH FROM THE OUTCOME
ALWAYS DO YOUR BEST

• Your best is going to change from moment to moment; it will be different when you are healthy as opposed to sick. Under any circumstance, simply do your best, and you will avoid self-judgement, self-abuse, and regret.

• DO YOUR BEST

Introduction to BioPAK

• Who?
  - General Dentist
    • Screen new patients
    • Referral for surgery
    • Monitor treatment
  - Orthodontist
  - TMD “Specialist”
  - Sleep Dentistry
Introduction to BioPAK

• Why?
  - Reliable data (Compare to Auscultation and Palpation)
  - Cost Effective Immediate Valuable Diagnostic Information
  - Utilizing ADA and FDA Approved Technology
  - Safe Testing with High Sensitivity and Specificity
  - Extremely Helpful in Treatment Decisions

Sensitivity and Specificity

• Sensitivity
  - The ability of the instrument to **detect the presence of disease** when it is truly present.
  - Do vibrations occur in the disease and are they consistent with the true disease?

• Specificity
  - The ability of the instrument to **detect the absence of disease** when it is truly absent
  - Does the healthy joint without joint vibrations appear normal without vibrations?
Maxillary Teeth related to Mandibular Teeth

Angle's Classification
Presence of Cross Bites
Anterior Guidance
Vertical

Introduction to BioPAK
WHAT?

BioPAK Modules

3 MODES

JVA
JVA Quick Joint Vibration Analysis
JVA/JT (With EGN)

EMG
Surface EMG
Electromyography
Functional and Resting

EGN
Computerized Jaw Tracking
Electrognathography
XY(ROM/Veloc) & Sweep
BioPak Recordings

- Joint Vibration Analysis
  - J VA Quick
  - J VA with Jaw Tracker
- Electrognathography
  - Range of Motion/Velocity XY Traces
  - Sweep Mode
- Electromyography
  - Resting
  - Functional

Normal EGN
Excellent Velocity with no Deviation or Deflection
Normal Velocity (EGN)

Abnormal EGN
Bradykynesia, Dysskynesia, and Deflection
Abnormal Velocity Trace
Cross over and Decreased Terminal Velocity

Joint Vibration Analysis
Second Module

- Vibrations
  - Use of accelerometers as opposed to microphones
  - Joint "Signatures"
  - Monitor Progress and Rate of Degenerative Diseases
  - Diagnosis of Intracapsular Disorders
  - Monitor Treatment Progress and Success
  - Eliminate guesswork - end unreliability of stethoscopes and palpation
JVA Operates on a very simple principle of motion and friction
Frequency Spectrum of Advanced Degenerative Changes
Radiographic/Imaging Evaluation

Panorex
Tomograms
Cervical and Facial Plain Films
Arthrogram
MRI
Saggital Corrected Tomograms

Practical Anatomy & Physiology

- Elevator Muscles
- Depressor Muscles
- Muscles of the Soft Palate
  - Muscles: Window of the Neuromuscular system
  - Normal Function
  - Parafuction
Re-introducing the “Family” of Muscles of Mastication

Temporalis

Lateral Pterygoid

Medial Pterygoid

Masseter

The Pterygoids...

“Pty” means “wing”, as in the Pterodactyl (winged finger dino)
Pterygoid plates of the Sphenoid bone

The origin of the “Pterygoid” muscles

One on the medial (internal) side, one on the lateral (external)
The force vector changes as the condyle translates.

The force vector changes as the condyle is translated.
Craniomandibular Musculature

- Temporalis and Masseter
Temporalis

Anterior segment is thickest & strongest; elevates mandible Superiorly/Anteriorly

One neuron recruits 900 fibers; 50% more efficient than masseter
Key Insertions at Infranuchal Line

- Semispinalis Capitus
- Spinalis Capitus
- Splenius Capitus
- Semispinalis
- Levator Scapulae

Something to go home with food for thought

- Muscle and TP over rated; Ligament insertion injuries under rated
Ligament Insertions

- Enthesis
- Weak point of the musculoskeletal system
- Often ignored

Acceleration/Deceleration Injuries

TM Joint Anatomy
Condylar Morphology

• Articulating Surfaces covered by fibrocartilage rather than hyaline cartilage

The condyle can have several shapes that are considered “normal”
Condylar morphology can be viewed with tomography from both a sagittal and coronal view. The coronal view allows us to look at the lateral and medial poles.
A panorex transposes the lateral pole to the head of the condyle. It is not reliable to evaluate joint health or joint posture.

Sagittal Corrected Tomograms
The TMJ is a ginglymoarthroidal synovial joint

- Hinge motion - ginglymoid
- Translation - arthrodial
- Disk: Two active articular surfaces
  - As opposed to meniscus (one active articular surface)
- Joint is lined with synovium which secretes synovium for lubrication and nutrition
- Joints are connected to a common bone and therefore function together
- Small amount of synovial fluid
TMJ Anatomy

- Attachment of superior head of the pterygoid
- Attachment of inferior head of the pterygoid
- Superior joint space
- Note Medial Attachment lower on condyle than lateral attachment

Normal Disk Function Video

Dental normal joint.asf
Disk

- Not a meniscus
  Attached and tethered
  Two Active Surfaces
- Biconcave
- Fibrocartilage
- Anterior Band
- Intermediate Zone
- Posterior Band

Key Concept: Tethering
Tethering

- Anterior: Pterygoid
- Posterior: Superior and inferior retrodiscal lamina
- Laterally: Collateral ligaments and the capsular ligament

MRI

Open

Note lack of translation

Note anterior displaced disk
Capsule

- Attached to temporal bone and neck of the condyle
- Supports condyle by resisting forces that tend to dislocate articular surfaces
- Retains synovial fluid and has high level of proprioceptive fibers

Ligaments of the TMJ

- Three functional ligaments
  1. The collateral ligaments
  2. The capsular ligament
  3. The temporomandibular ligament
     1. Lateral aspect reinforced by this ligament
        - Limits opening and controls opening
     2. Outer oblique and inner horizontal
        - Limits posteriorization
Accessory Ligaments

• Stylomandibular
  - Limits protrusion
• Sphenomanidbular
  - No specific known function
Synovial Fluid

- Produced in synovial sacs and lining of capsule
- Nutrients
- Lubrication
  - Boundary
  - Weeping

PRIMARY INTRACAPSULAR DISORDERS

Internal Derangements
Degenerative Joint Disease
Normal Disk Function Video

Normal JVA/JT Raw Data
Disk Displacement With Reduction Video

Disk Displacement with Reduction
Waveform of a Disk Displacement with Reduction

- High Amplitude
- Short Duration
- Integral Above 80
- Mirror Image
- Las Vegas Ride
Disk Displacement Without Reduction Video
Disk Displacement Without Reduction
Computer set up including entering new patient
Measuring opening and evaluating for deflections
Select JVA Quick Recording mode
  - Note that the program opens to recording mode for new patients
Patient Instructions; Importance of timing and significant tooth contact
Primary Intra-capsular Example
Robert G

57 year old male
CC
- Headaches
- Episodic Locking
- Ear Stuffiness and Ringing

Note JVA and episodic locking;
Tomograms demonstrate ability for full translation
Robert G

- 9/22/03  Max B splint inserted
- 10/13/03  Reports no locking with decrease in HA
- 10/27/03  Ear symptoms improved
- 11/17/03  Symptoms remain improved with no pain or locking; consider prolotherapy; proceed with exercise program
- Final Status
POST TREATMENT VELOCITY TRACE WITHOUT APPLIANCE
Symptom

<table>
<thead>
<tr>
<th>Headache Intensity</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headache Frequency</td>
<td>5</td>
</tr>
<tr>
<td>Jaw Locking</td>
<td>5</td>
</tr>
<tr>
<td>Ear Ringing</td>
<td>5</td>
</tr>
<tr>
<td>Ear Stuffiness</td>
<td>5</td>
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</tbody>
</table>

Clench with Enhanced Anterior Deprogrammer (NTI)
MIP


Rest on chemo
### Effect of Enhanced Deprogrammer

<table>
<thead>
<tr>
<th></th>
<th>Clench MI</th>
<th>Clench Deprogrammer</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>TA – R</td>
<td>149.1</td>
<td>19.9</td>
<td>13%</td>
</tr>
<tr>
<td>TA – L</td>
<td>120.5</td>
<td>17.5</td>
<td>15%</td>
</tr>
<tr>
<td>MM – R</td>
<td>131.0</td>
<td>332</td>
<td>25%</td>
</tr>
<tr>
<td>MM – L</td>
<td>123.2</td>
<td>29.1</td>
<td>24%</td>
</tr>
</tbody>
</table>
Parafunctional Control

- Used in both primary intracapsular and extracapsular cases

Diagnosis
Baseline Joint/Muscle function
Parafunctional Control
Monitor and Evaluate Signs and Symptoms

BEFORE AND AFTER NTI
TX ONLY
Something to go home with food for thought

- Muscle and TP over rated; Ligament insertion injuries under rated

Ligament Insertions

- Enthesis
- Weak point of the musculoskeletal system
- Often ignored

Acceleration/Deceleration Injuries
Innervation (sensory and motor) and Masticatory Function
Migraine and TMD: The Trigeminally Mediated Disorders

Barry Glassman, DMD
Co-Medical Director - St. Lukes Headache Center
Director – The Allentown Pain Center

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www.allentownpaincenter.com
Migraine involves abnormal sensory modulation.

Migraine involves dysfunction of brain-stem pathways that normally modulate sensory input. The key pathways for the pain are the trigeminal spinal nucleus from the nasal trigeminal sensory input, which passes through the trigeminal ganglion and synapses on second-order neurons in the trigemino-cervical nucleus. These neurons, in turn, project through the oculomotor tract and after decussating in the brain stem, form synapses with neurons in the thalamus. There is a reflex connection between neurons in the pons and the superficial sensory nucleus, which results in a central parasympathetic outflow that is mediated through the parasympathetic, sphenopalatine ganglia, and second ganglion. This trigeminal-autonomic reflex is present in normal persons and is exaggerated in patients with trigeminal-autonomic cephalalgias, such as cluster headache and paroxysmal hemicrania. It may be active in migraine.

Gut's imaging studies suggest that important modulation of the trigeminal-sphenopalatine ganglia input comes from the dorsal raphae nuclei, locus ceruleus, and nucleus raphae magnus.
Migraine Without Aura (Common Migraine)

Headache has > 2 of the following
- Unilateral
- Throbbing
- Moderate to Severe
- Aggravated by movement

One of the following
- Nausea
- Photo and phonophobia

Initiation of Migraine Cascade
How does the Sensory Nucleus become “sensitized”?

Abnormal Sensory Modulation

Nasal mucosa

Normal afferent pathway
1 of every 5 Corvettes shuts down for 2 days every other month or so.

1 in 5 adult women shut down for 2 days every other month or so.
- Intense headache, with nausea
- Sinus congestion, throbbing.
- Sore, aching jaw

1 in 5 adult women shut-down for 2 days every other month or so.
Parafunction's influence on the Trigeminal Sensory Nucleus

Migraine involves abnormal sensory modulation.

How can the treatment for teeth grinding reduce migraine pain events?

NTI: FDA approved for the prevention of medically diagnosed migraine pain; 87% of subjects had a 77% average reduction of migraine events.
How can reduction of nocturnal clenching intensity reduce migraine pain events?

NTI: FDA approved for the prevention of medically diagnosed migraine pain; 87% of subjects had a 77% average reduction of migraine events.

How can reduction of Trigeminal hyper-motor; noxious sensory activity reduce migraine pain events?

NTI: FDA approved for the prevention of medically diagnosed migraine pain; 87% of subjects had a 77% average reduction of migraine events.
How can reduction of Trigeminal hyper-motor; noxious sensory activity improve Trigeminal sensory modulation?

How can it not?

NTI: FDA approved for the prevention of medically diagnosed migraine pain;
87% of subjects had a 77% average reduction of migraine events