

**This 33-slide presentation identifies the causative and perpetuating muscular elements of TMD, and introduces the new "NTI Clenching Suppression System".**

**To review the related accompanying article, go to: Identifying the Dominant Force of Bruxism: Treatment and Prevention of TMD and Chronic Headache using a New Clenching Suppression Device.**

# **Treatment and Prevention of TMD and Chronic Headache Using a New Clenching Suppression Device:**



***Identifying the  
Dominant Force  
of Bruxism***

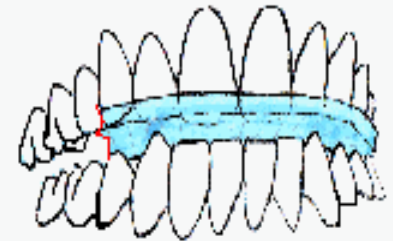
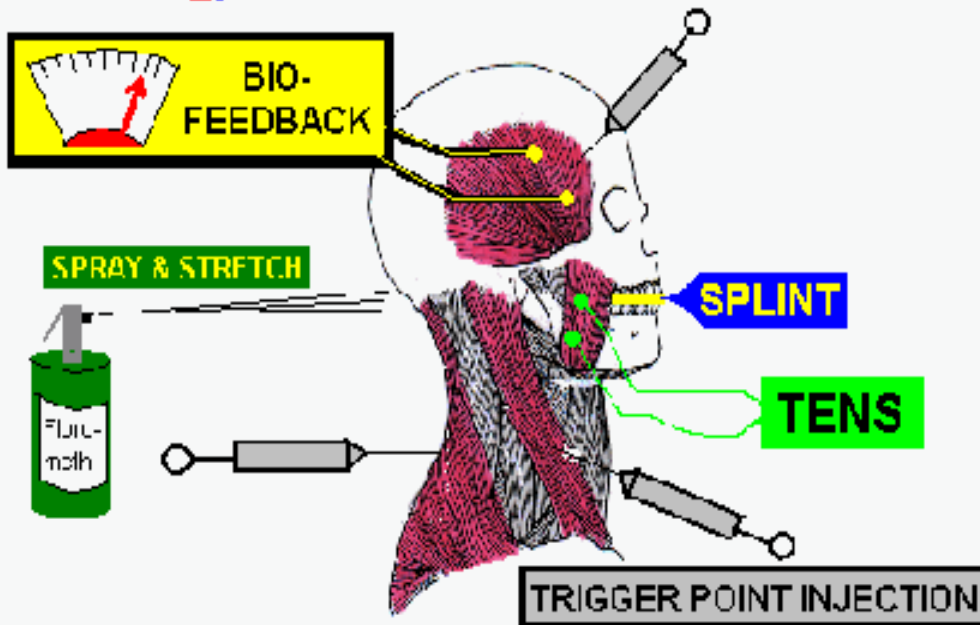
## Signs and Symptoms:

- Stiff and sore jaw;
- Tooth wear &/or damage;
- TMJ pain and/or dysfunction;
- Chronic tension-type Headache

## Typical Therapy:

- Occlusal Splint;
- TMD "management";
- Perpetual Pharmacology

# Management of MPD/TMD



Splint failure and/or non-compliance

Treatment for MPD and/or TMD becomes "management" when splint therapy fails...

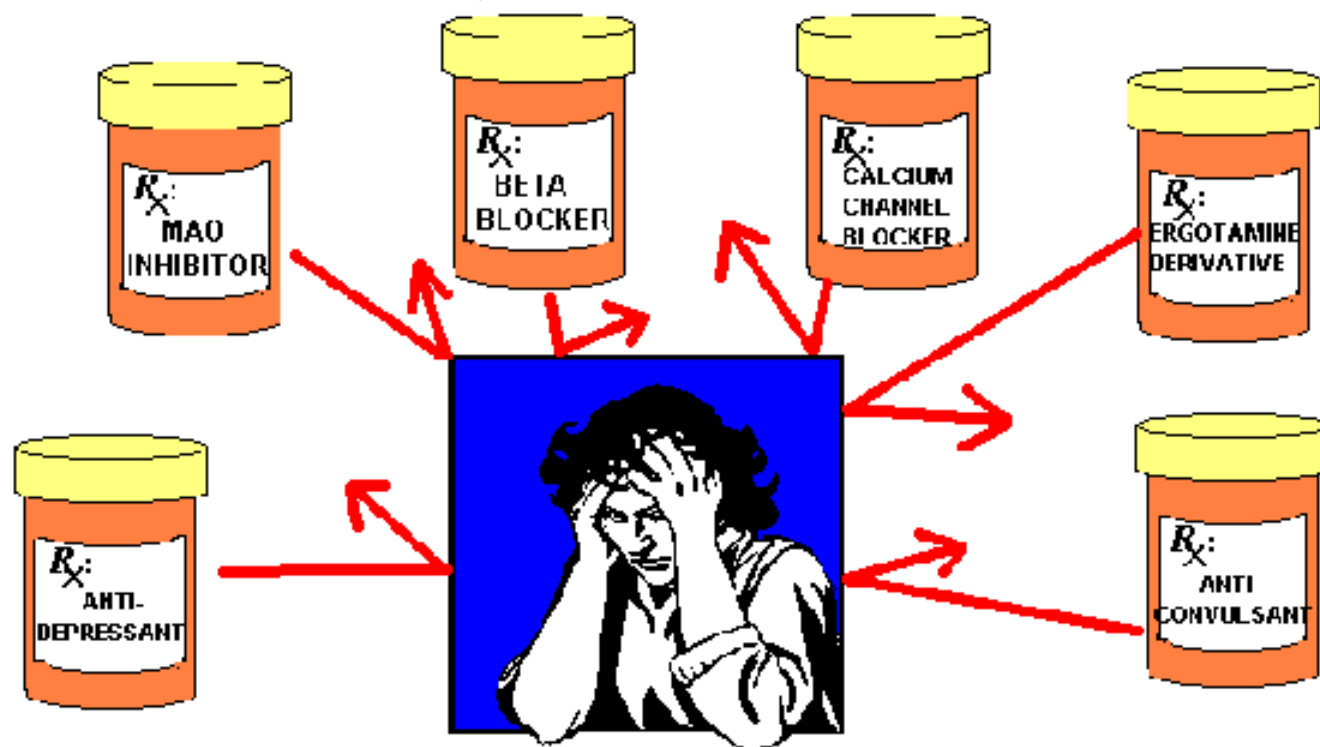
-- TMD diagnosis has increased by 20% in past year...  
...but is referred out by 65% of general dentists.

**TMD treatment becomes TMD management when splint therapy does not provide adequate relief.**

**Typically, the patient with chronic head and neck pain is seeing a physician for preventive medications...**

Rx failure: Lack of desired response or non-compliance due to side effects

## Preventive Pharmacotherapy of Head, Neck and Face Pain



Although none of the above medications are specifically intended to prevent neuromuscular pain, they are perscribed with the hope that symptoms are reduced while the side-effects are tolerated.

## The Source... "Bruxism"

Current causal definition: Clenching or grinding of the teeth

*Bruxism is NOT a condition  
OF the teeth...  
but is a condition which  
AFFECTS the teeth.*

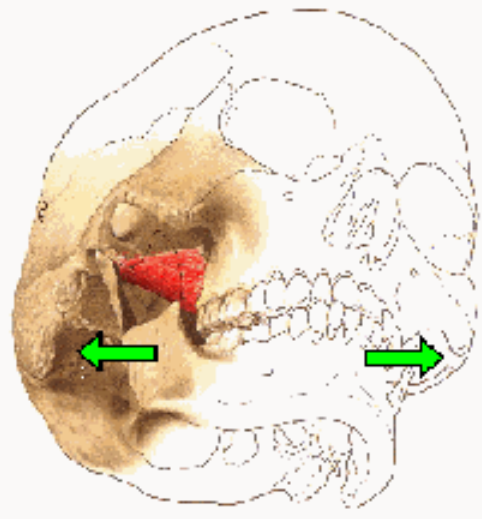
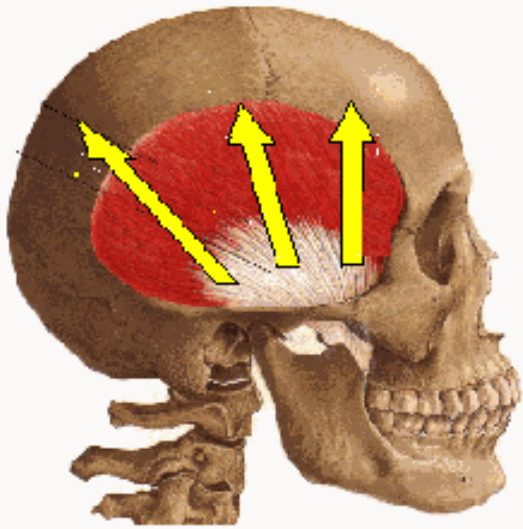


**Bruxism: Intense Jaw-Clenching,  
with or without forcible excursive movement.**

***The intensity of **Temporalis** clenching dictates  
the severity of **Lateral Pterygoid** grinding...***

**If the jaws were not clenched together, lateral pterygoid activity would go unopposed by any occluding teeth, and the mandible therefore would simply swing freely from side to side.**

Bruxism: The dynamic relationship between...  
Temporalis vs. Lateral Pterygoid



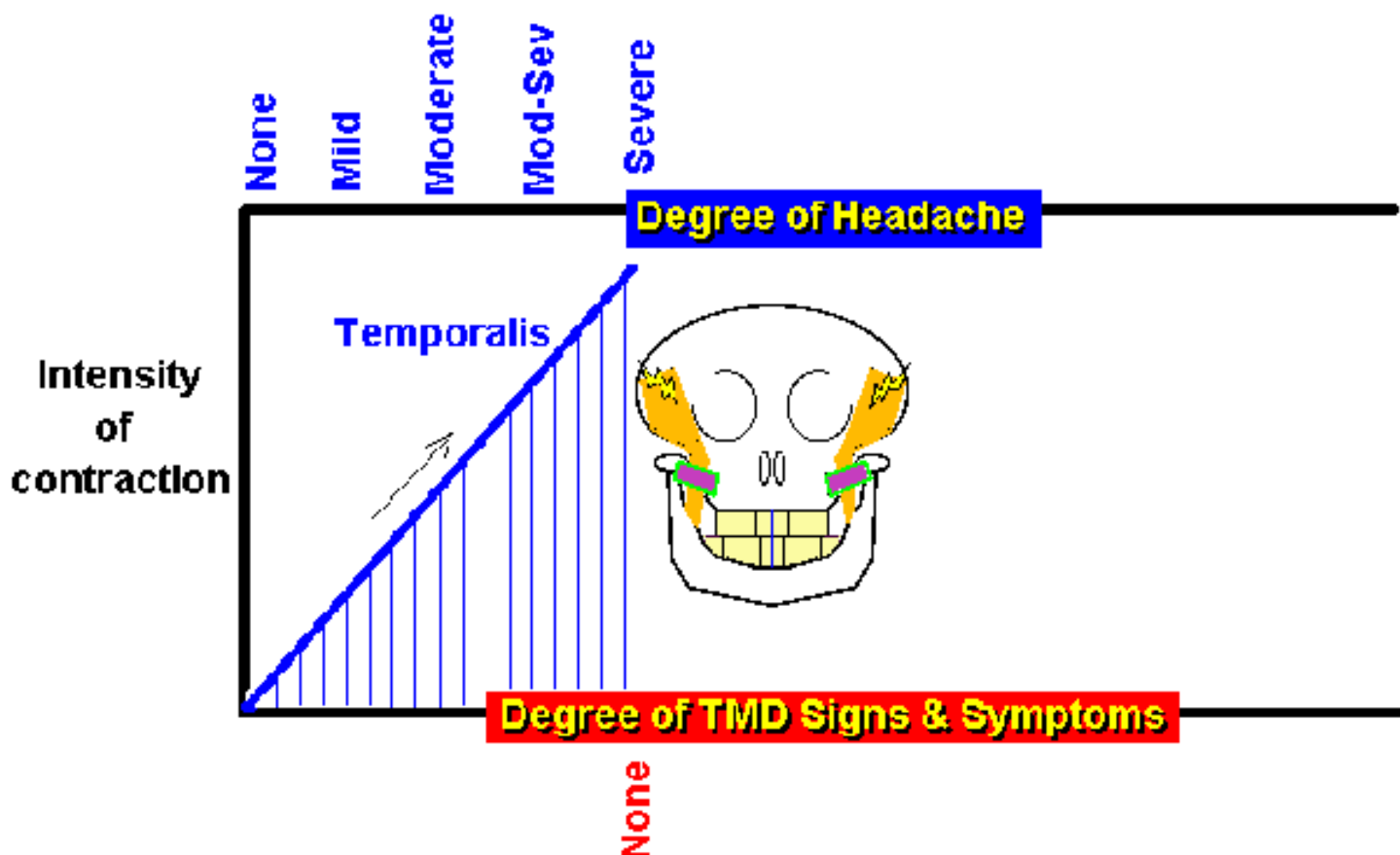
Vertical  
Jaw-Clenching

Horizontal  
Teeth-grinding

*Compete in 90 degree opposition*

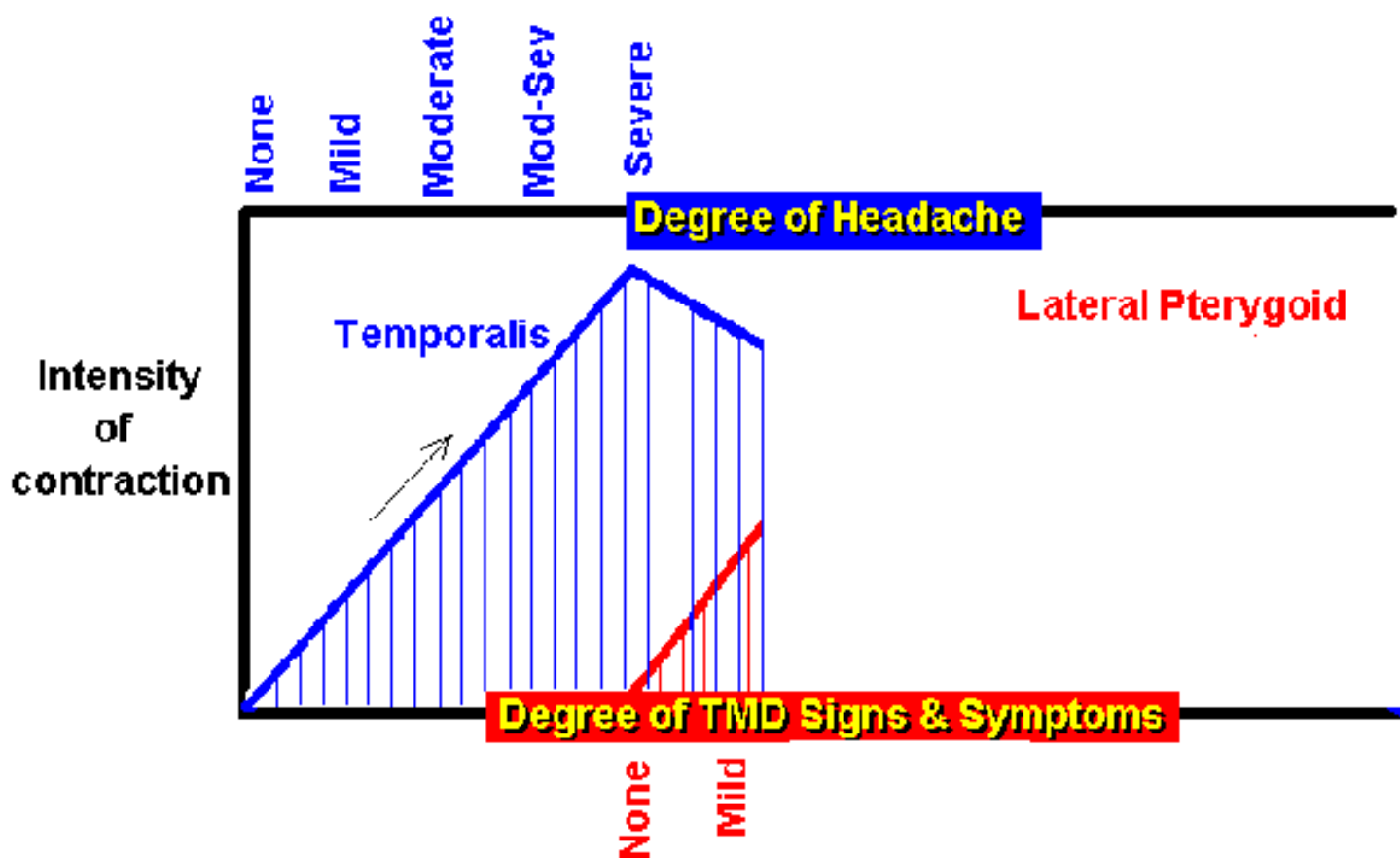
As the intensity of temporalis contraction increases, so does the severity of headache. When the temporalis is in maximum contraction, there is no possibility for any lateral pterygoid activity, called "Primary Clenching". Other than chronic headache, there are no usual and customary symptoms of TMD.

## Dynamic "Muscular" Bruxism



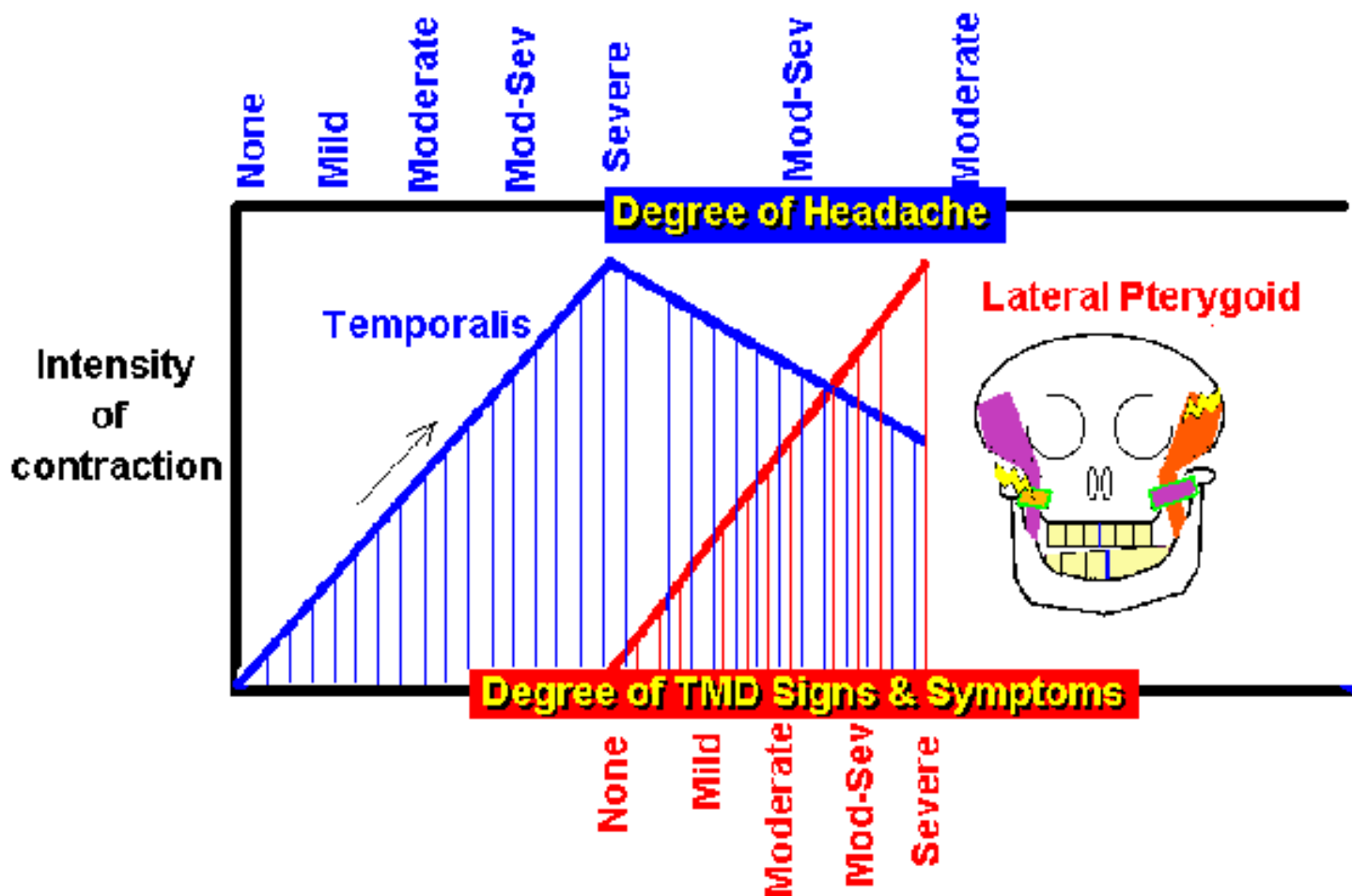
As temporalis contraction intensity decreases, the lateral pterygoid can begin to increase its strain on the TMJ and pterygoid plate (the insertion and origin of the muscle), thereby increasing the signs and symptoms of TMD.

## Dynamic “Muscular” Bruxism



The most intense contraction of the lateral pterygoid applying the most strain to the joint and facial bones is when the temporalis' contraction is providing significant occluding resistance to the lateral pterygoid, without letting the mandible shift freely. This results in either severe teeth grinding and/or "excursive clenching" and/or severe TMD.

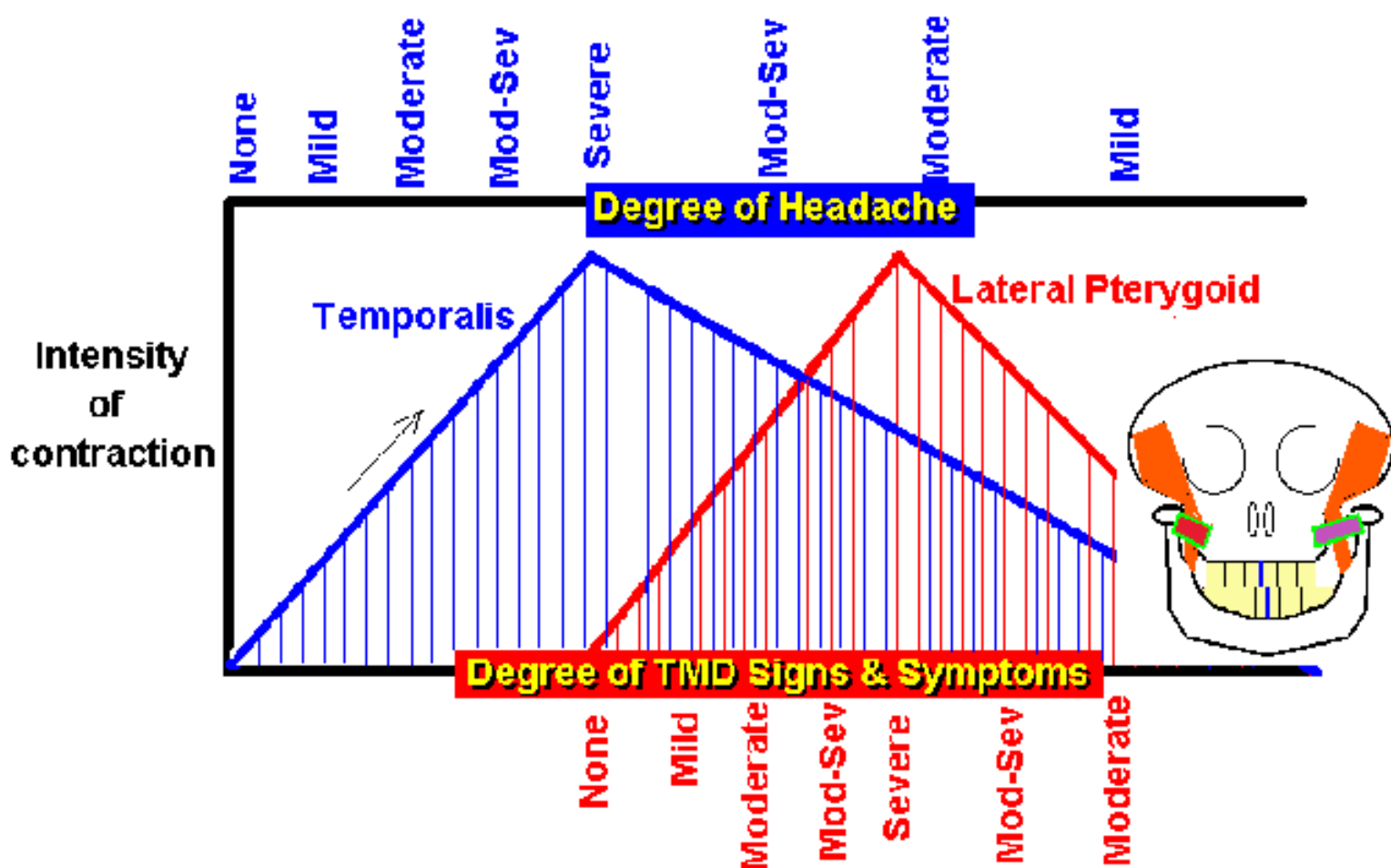
## Dynamic "Muscular" Bruxism





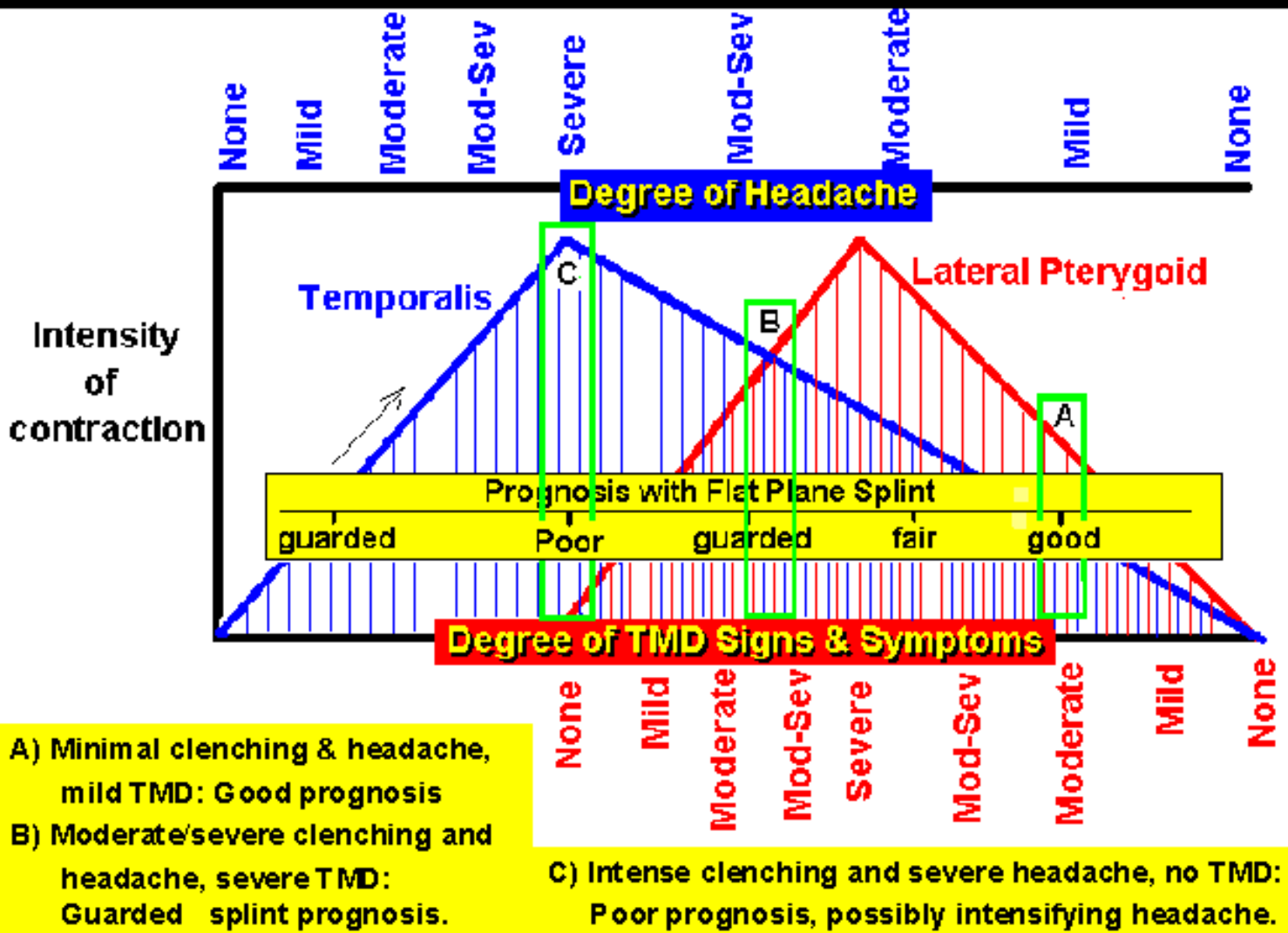
As temporalis contraction provides less resistance to lateral pterygoid contraction, the mandible can move more freely while the teeth are still occluding, resulting in teeth grinding and minimal symptoms.

## Dynamic “Muscular” Bruxism



The more intense the temporalis contraction, the poorer the prognosis is for the splint to aid in reduction of symptoms.

## Splint Prognosis: A Function of Temporalis Contraction Intensity

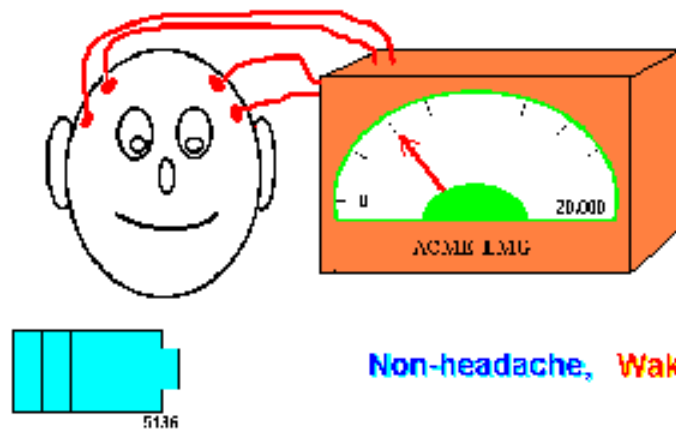


Example patient "C" above (primary clenching) is typically diagnosed with "Tension-type" headache.

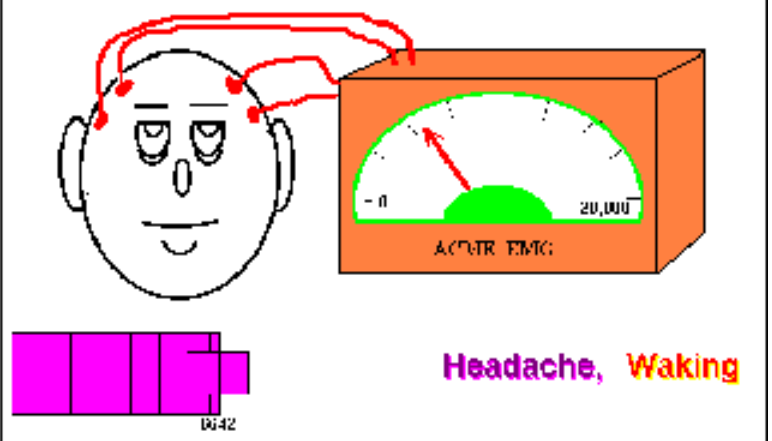
**Tension-type headache patients without TMD, on average, contract their temporalis' during sleep (clench) 14 times more intensely than asymptomatic controls.**

**Tension-type Headache patients *without* "TMD" clench during sleep \*14 times\* harder that asymptomatic controls.**

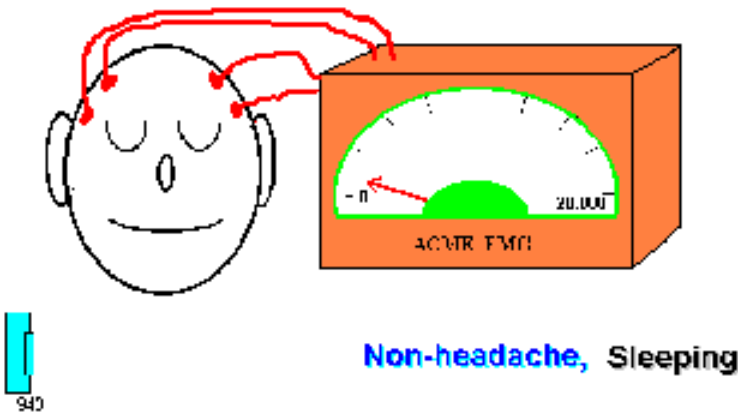
"Waking and Sleeping EMG Levels in Tension-Type Headache Patients" J.Oro. Pain, Vol.11, #4, 1997



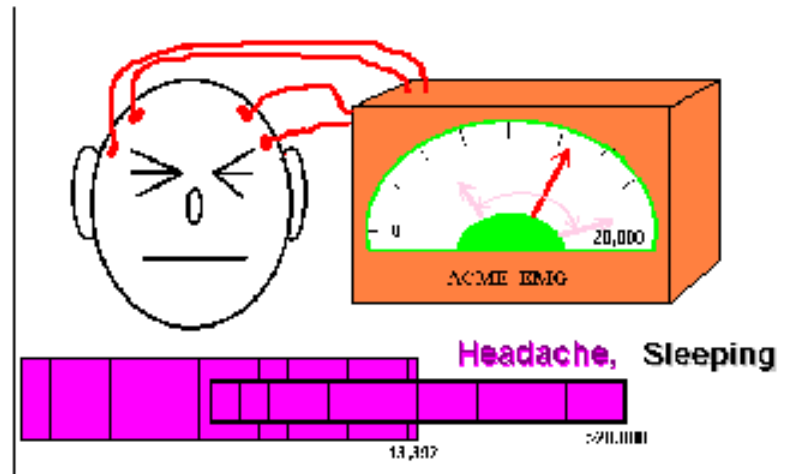
**Non-headache, Waking**



**Headache, Waking**



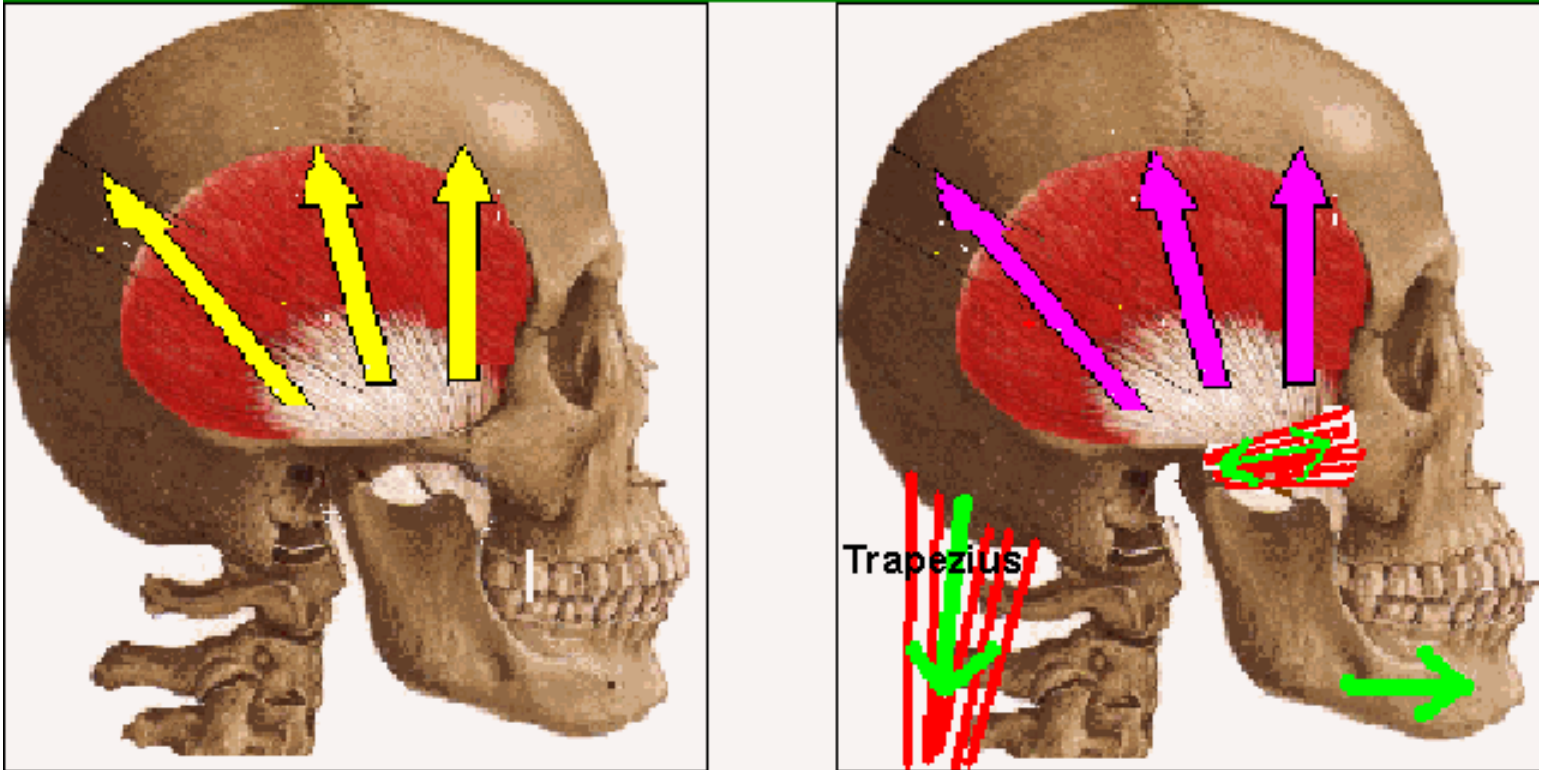
**Non-headache, Sleeping**



**Headache, Sleeping**

**Without any strain from the lateral pterygoid, the typical Tension-type headache patient may have no TMD symptoms at all if they are "primary clenchers".**

# Clenching in a protrusive position



Temporalis intensity is maximal in CR, but not in protrusive...

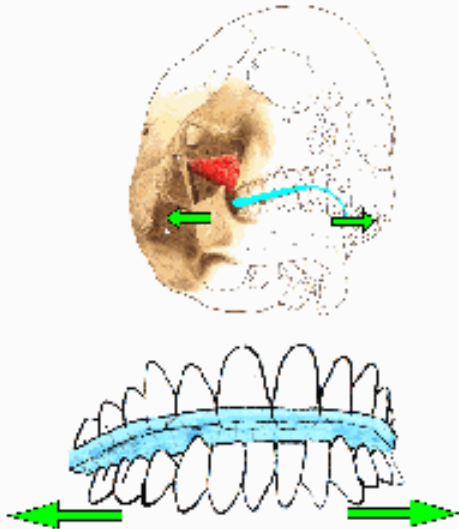
Static protrusive clenching allows Lateral Pterygoid contraction which strains the pterygoid plate of the sphenoid (sinus) bone. Protrusive clenching obligates the trapezius to maintain tension to stabilize the skull.

When clenching the jaw in a protrusive position, temporalis contraction is less efficient and therefore temporal headache may not be presented as a chief complaint. However, static strain on the pterygoid plates of the sinuses due to Lateral Pterygoid contraction causes sinus symptoms \*in the absence of disease\*, that is, pain, pressure and swelling. Simultaneously, in order to stabilize the skull, neck musculature is obligated to contract during protrusive clenching. Typically, the patient will complain of a stiff, sore and/or painful neck and a headache radiating from the base of the skull.

**Dentistry typically treats symptoms that are "below the cheekbone". When the lateral pterygoid's symptoms are dominate, splint therapy has a good prognosis.**

## Lateral Pterygoid

Joint strain , discomfort, limited ROM, "sinus" pain

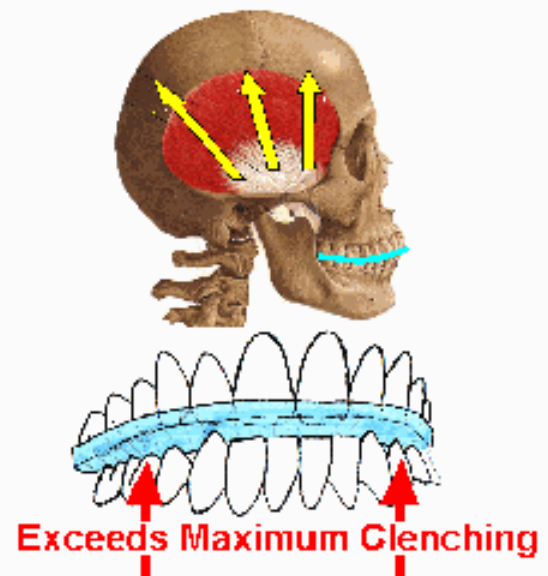


**Minimal Resistance = Minimal Effort**

**By eliminating the resistance of tooth contacts in excursive movements, a splint allows the Lat. Pter-ygoids to contract less intensely. Therefore, TMJ system strain is less, thereby relieving symptoms.**

## Temporalis

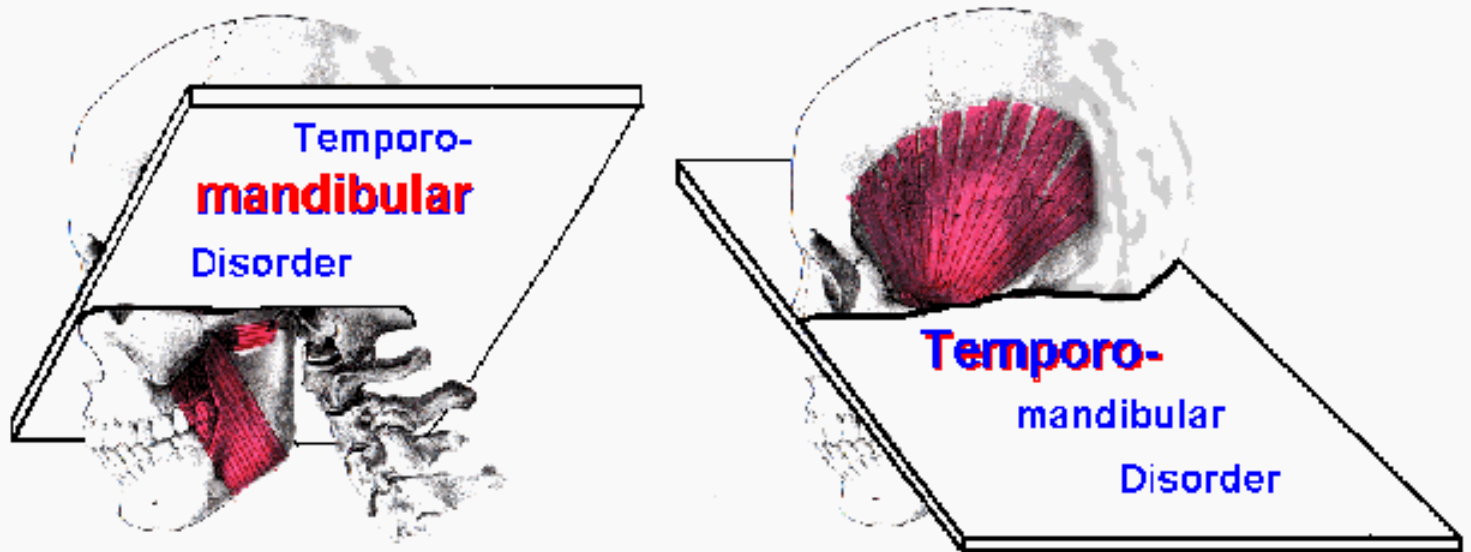
Headache, facial pain



**Evenly distributed occluding forces on the same splint provides a more efficient clenching surface. Therefore, Temporalis intensity can maintain or increase, thereby maintaining or increasing symptoms.**

**Rarely can the dentist predict which patient will simply continue to clench on their splint, thereby perpetuating, or intensifying, their condition.**

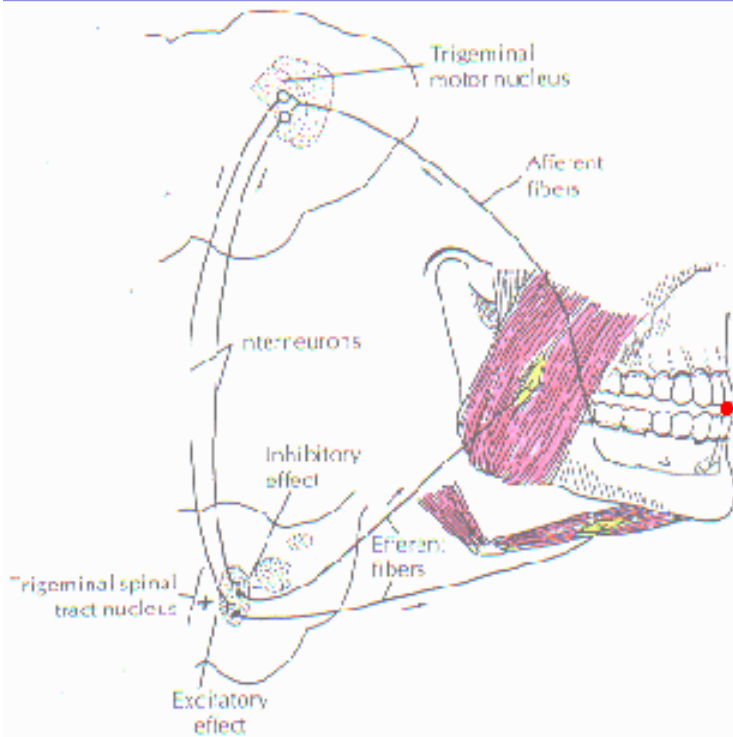
Dentistry is efficient and predictable  
treating the *mandibular half* of TMD...



... but unpredictable and inefficient at  
treating the *temporal half*.

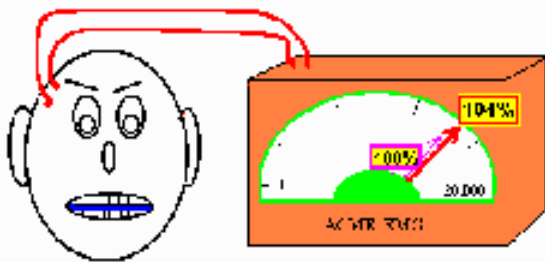
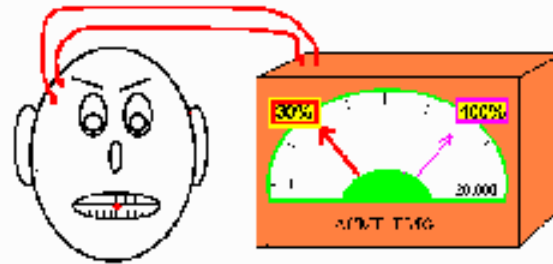
**In order to "control" temporomandibular muscular parafunction, clenching must be suppressed. An anterior, midline point stop triggers the Nociceptive Trigeminal Inhibition reflex (or jaw-opening-reflex) suppresses jaw-closing muscles, and allows seating of the condyles in their most superior-anterior position.**

**TO TREAT AND PREVENT SIGNS AND SYMPTOMS OF BRUXISM, CLENCHING MUST BE SUPPRESSED**



**Nociceptive Trigeminal Inhibition suppresses clenching with an anterior point stop. (jaw-opening-reflex)**

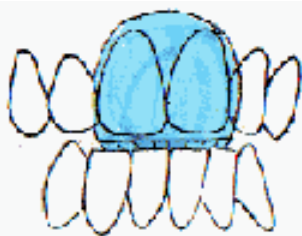
**An anterior-point-stop will suppress jaw elevators and << excites jaw depressors.**



**An anterior-point-stop (above) suppresses maximal clenching to 1/3 of maximum, while a splint (left) allows 104% of maximum**

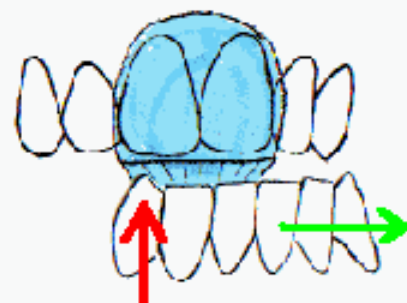
**When comparing an anterior point stop to a full-arch splint, clenching intensity can be 104% of voluntary maximum, while an anterior point stop suppressed clenching intensity to 33% of voluntary maximum.**

**An anterior deprogrammer, or jig, is commonly used to relax musculature and to seat the condyles in their most musculo-skeletal stable (superior-anterior) position. Canine occlusion (on the deprogrammer) allows for near maximal ipsilaterally clenching in addition to joint strain.**

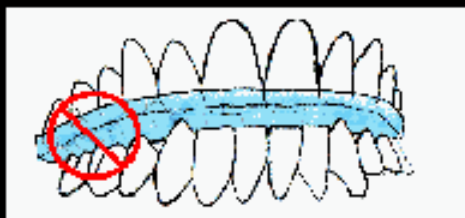


An “anterior deprogrammer” exploits the jaw-opening-reflex, providing relaxed musculature and improved condylar position (CR), and is recommended for acute muscular episodes...

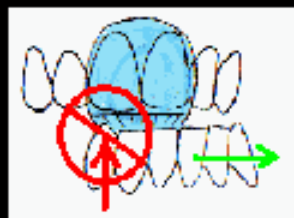
but is contra-indicated in the event of excessive or protrusive movements, due to canine contact on the device, allowing near maximal Temporalis contraction and TMJ strain.



## Clenching Suppression Requires:



No Posterior Occluding



No Canine Occluding

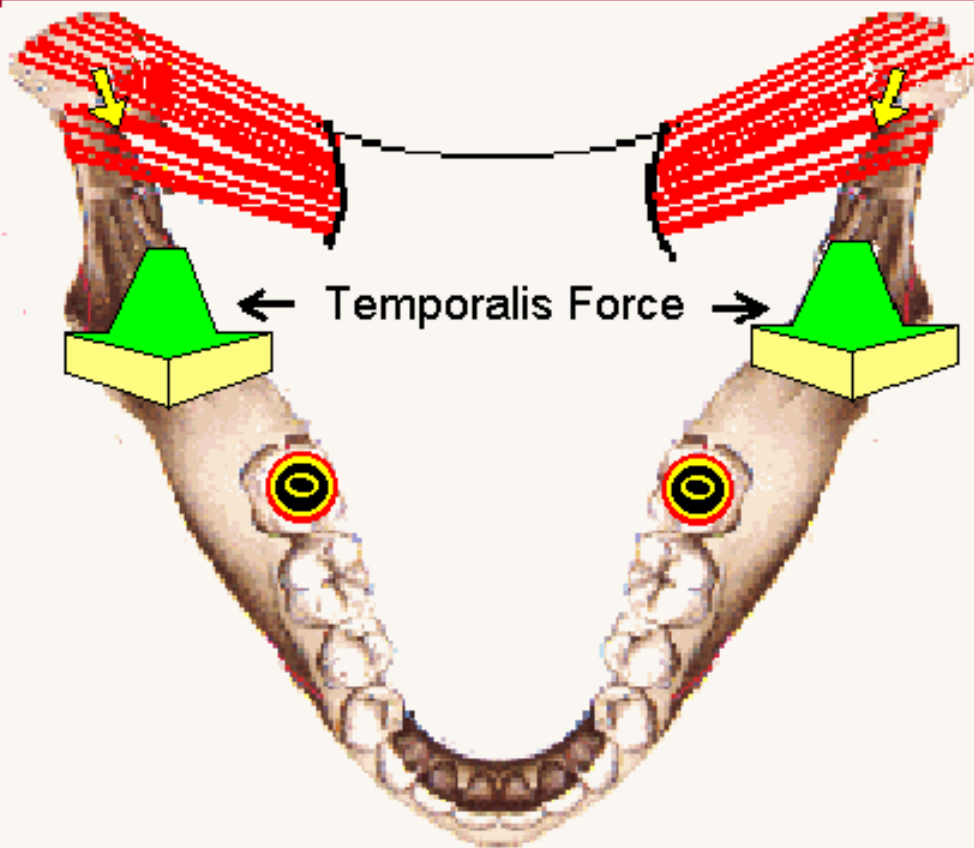
**In order to suppress clenching in a therapeutic, dynamic environment, there can be no posterior occluding (minimizing clenching), and no canine occlusion, thereby preventing joint strain.**



**Bilateral, equal contacts minimize joint strain, but maximize temporalis clenching.**

TMJ strain: A function of point of contact & muscle activity

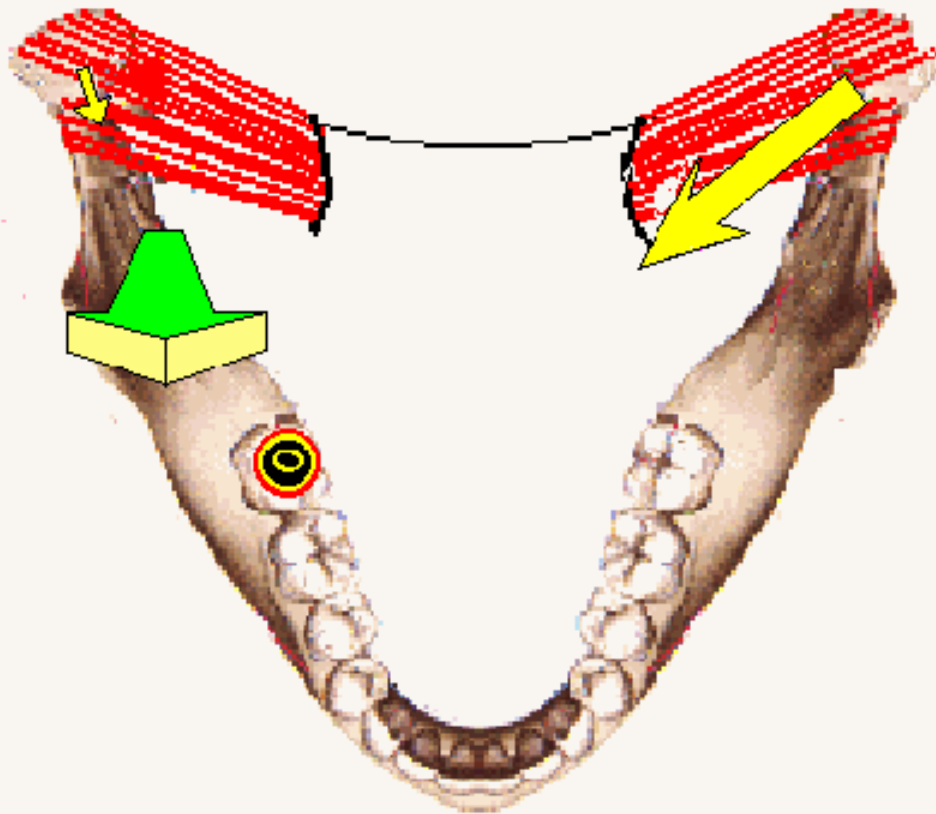
**Minimal strain:** Equal, bilateral contacts



**A unilateral, posterior contact stabilizes the ipsilateral joint, but allows the contra-lateral lateral pterygoid to significantly strain the contra-lateral TMJ (the vector force direction is towards the contact).**

**TMJ strain: A function of point of contact & muscle activity**

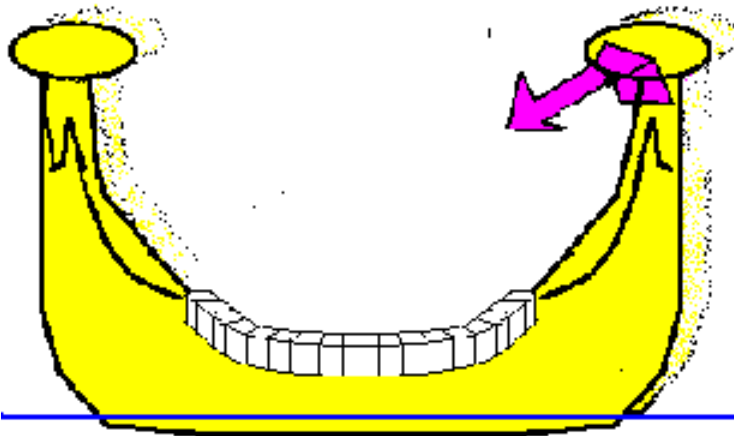
**Maximum strain: Unilateral posterior contact**



**Left side: With a unilateral posterior occlusal stop, the ipsilateral temporalis clenches on the contact, stabilizing the TMJ on the ipsilateral side, while the contralateral lateral pterygoid contacts and strains and contorts the contralateral TMJ structures, thereby displacing the disc, damaging it, etc.**

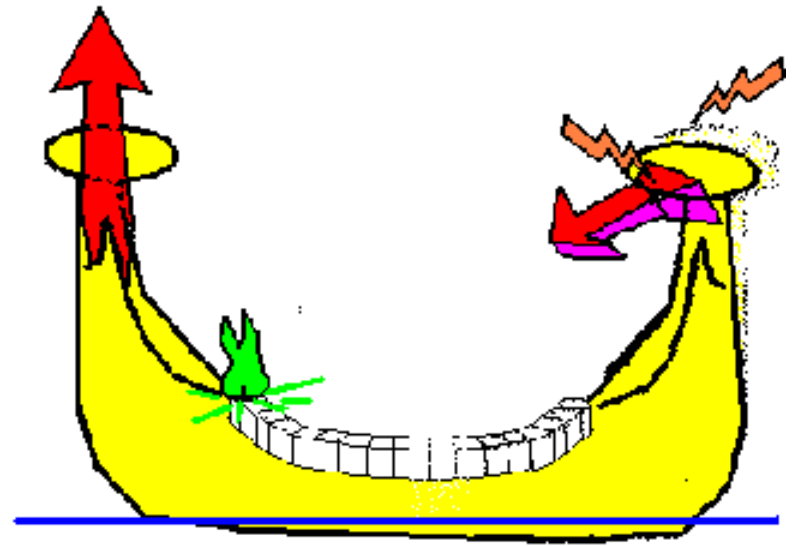
**Right side: With no occlusal stops, a unilateral contraction of a lateral pterygoid simple shifts the mandible excursively.**

*Excursive Clenching* can result in:  
**Joint Strain --> Derangement --> Damage**



**Unilateral contraction of  
Lateral Pterygoid  
causes excursive movement**

*No Joint Strain in  
Dynamic Movement*



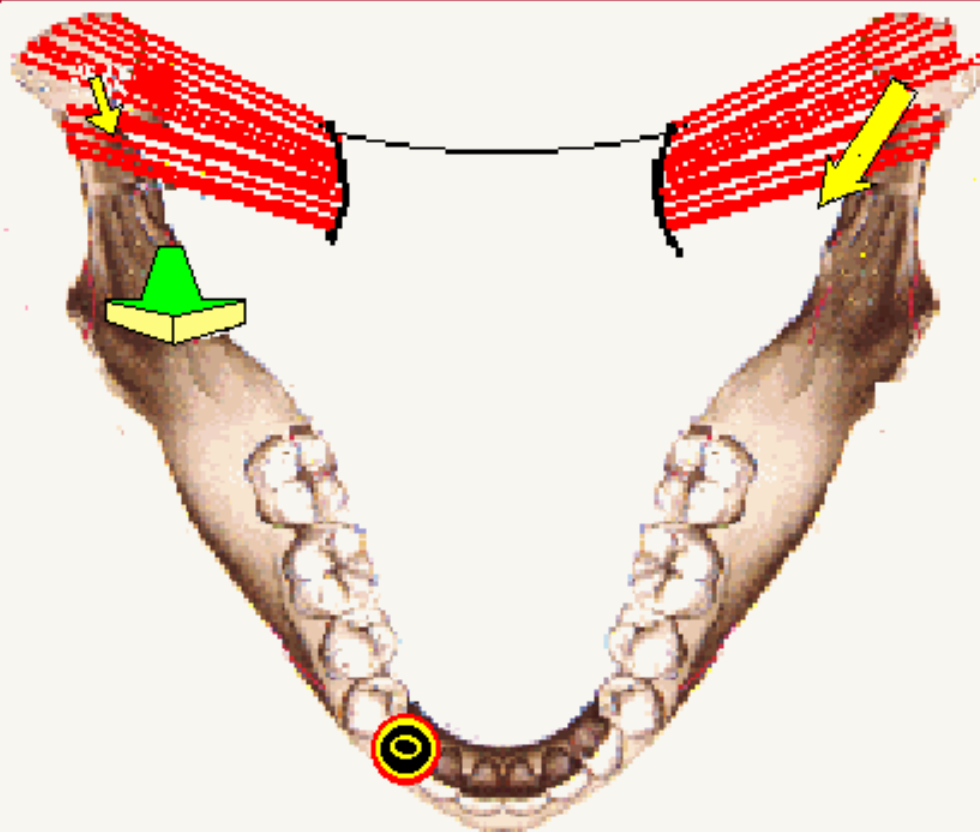
**Unilateral contraction of  
Lateral Pterygoid & opposite  
contraction of temporalis =  
unilateral excursive clenching**

*Static strain causes damage*

**A unilateral canine contact allows less joint strain than a unilateral posterior stop.**

TMJ strain: A function of point of contact & muscle activity

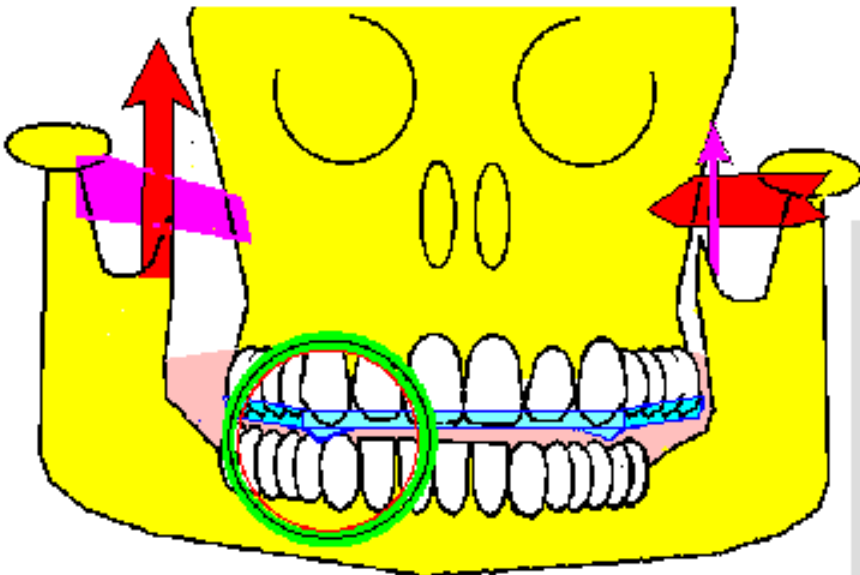
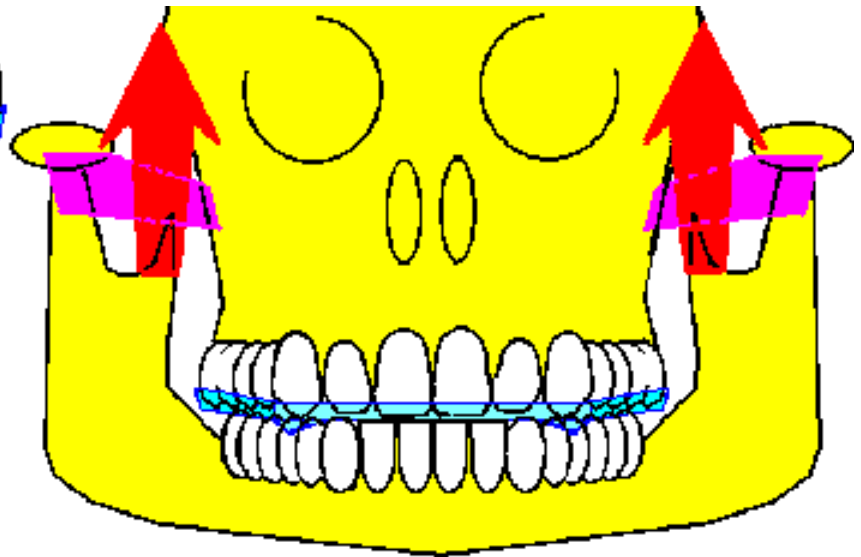
**Moderate strain:** Unilateral canine contact



**A flat-plane splint with cuspid rise allows for less joint strain, because the force vectors are less of in a medial direction.**



**FLAT PLANE  
with  
CANINE GUIDANCE**



**NO JOINT STRAIN  
in centric relation, but w/  
MAXIMUM CLENCHING  
POTENTIAL**

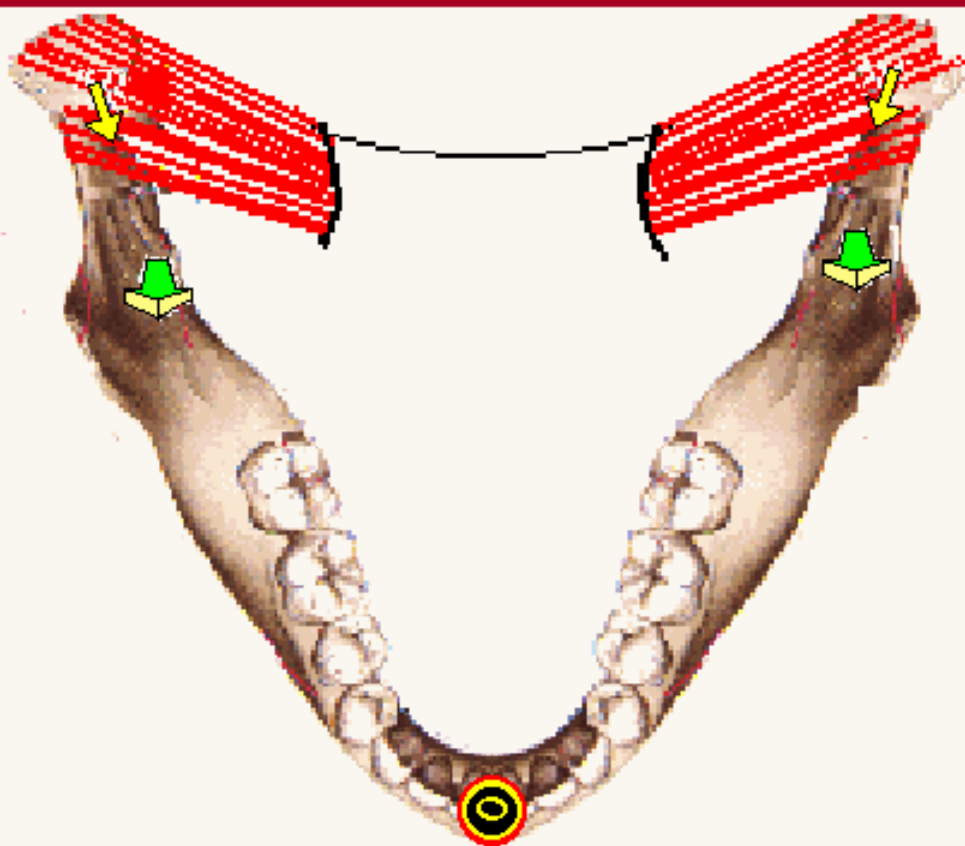
**EXCURSIVE UNILATERAL  
CANINE CONTACT:  
Ipsilateral near-maximal  
clench; Contralateral lateral  
pterygoid w/ potential  
perpetuating joint strain**

**This splint continues to allow for maximal clenching intensity.**

**An anterior, midline point stop allows for 1/3 maximal temporalis clenching intensity, and prevents the lateral pterygoids from straining the joint by eliminating unilateral occlusal stops. A therapeutic goal would be to exploit the effect of an anterior, midline point stop in a dynamic environment.**

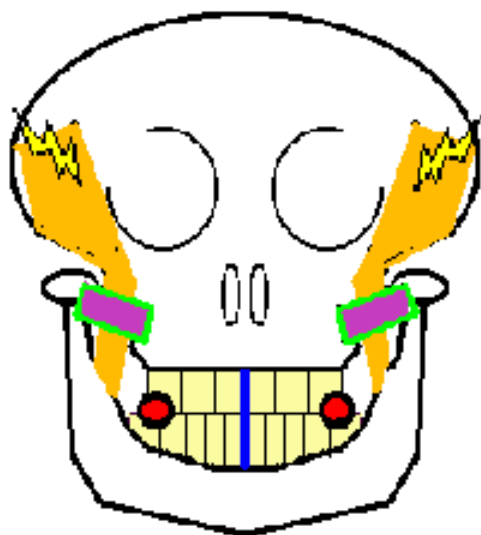
TMJ strain: A function of point of contact & muscle activity

**Minimal strain: Anterior mid-line contact**



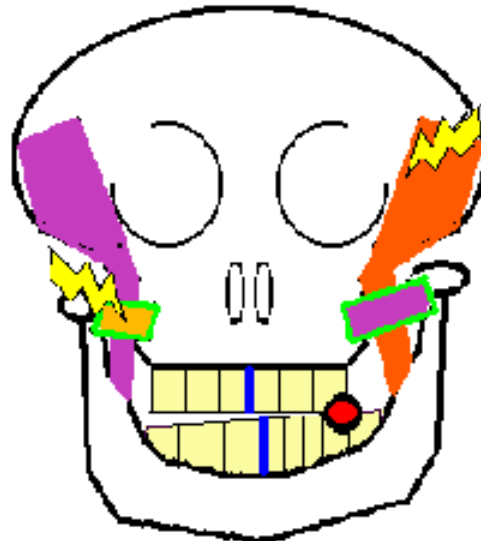
**Joint Strain A Function of:**  
**Occlusal Contact Scheme**  
**and *Muscle Contraction Intensity***

Posterior bilateral  
equal contacts



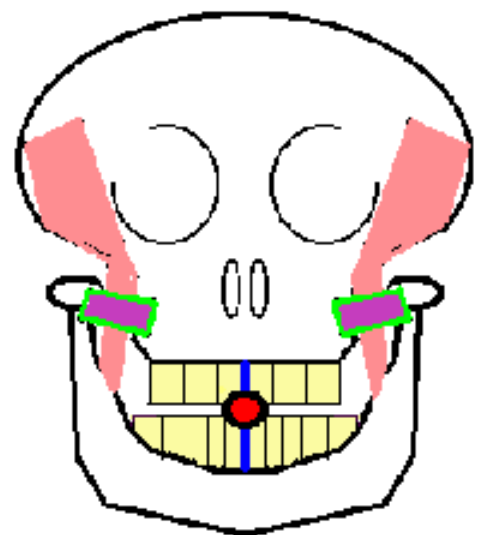
No  
joint strain

Posterior unilateral  
contact



Maximal  
joint strain

Anterior midline  
point contact



Minimal  
joint strain

**The NTI device provides suppression of muscular contraction while allowing minimal joint strain in a dynamic environment.**



**Fulfills requirements of:**  
Clenching Suppression;  
TMJ strain reduction;  
Reversibility.



**Centric**



**Protrusive**



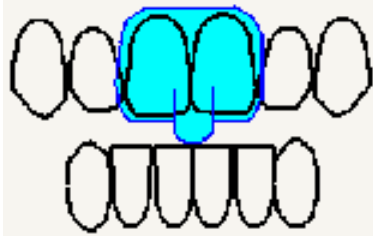
**Excursive**

**Prevention of posterior or canine occluding provides suppression of jaw elevators in a dynamic environment.**

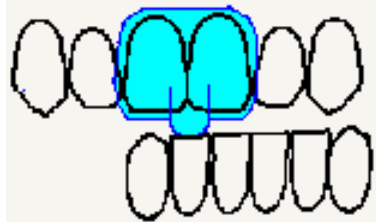
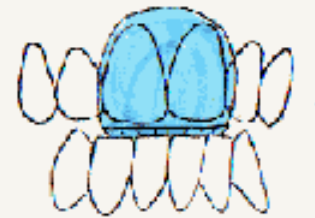
- **Relieves Morning Headache; Suppressed Clenching**
- **Relieves TMJ strain and TMD; Suppressed Grinding**
- **Prevents trauma to teeth and restorations**



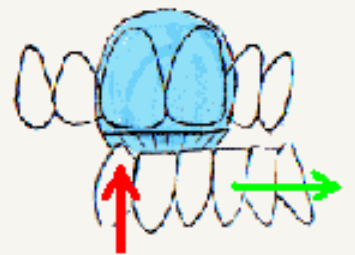
## Comparing NTI to a Deprogrammer



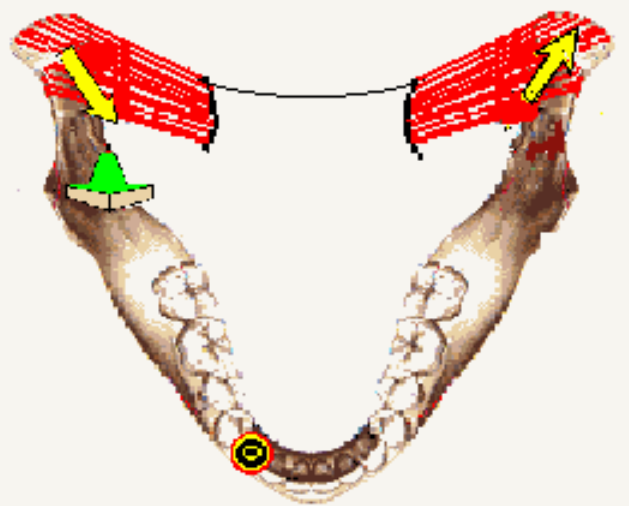
Both suppress clenching and minimize joint strain in centric...



...deprogrammer provides canine contact in excursive, allowing joint strain



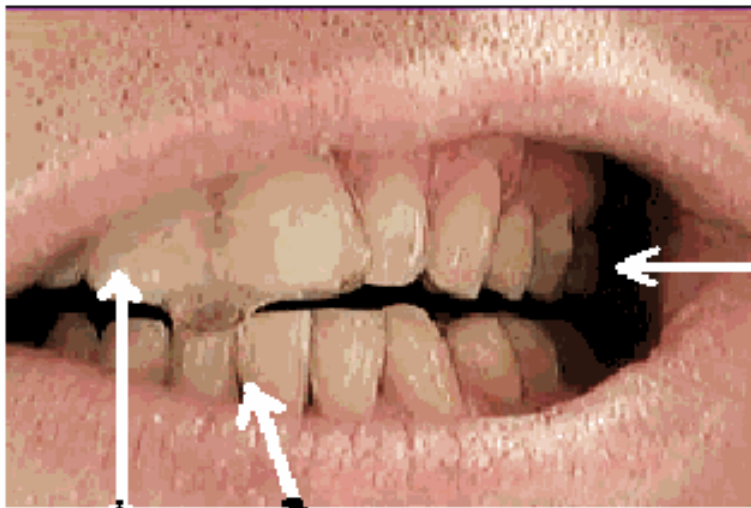
Joint strain results from:  
Unilateral lateral pterygoid with temporalis clenching, creating canine contact, resulting in ipsilateral joint strain and contralateral joint compaction.



**Muscular parafunction, by definition, occurs when the patient is NOT chewing food (chewing is function). The NTI is worn only in the presence of parafunction.**

## Inherent Adverse Results?... None.

The *NTI* device is used during *parafunction*, therefore preventing any *functional* adaptation.



**Joint Strain, Disc Trauma?**  
Optimal condylar position & minimal muscle contraction allow joint protection

**Supra-eruption?**  
Daily function and stimulation prevent tooth movement.

### **Aspiration?**

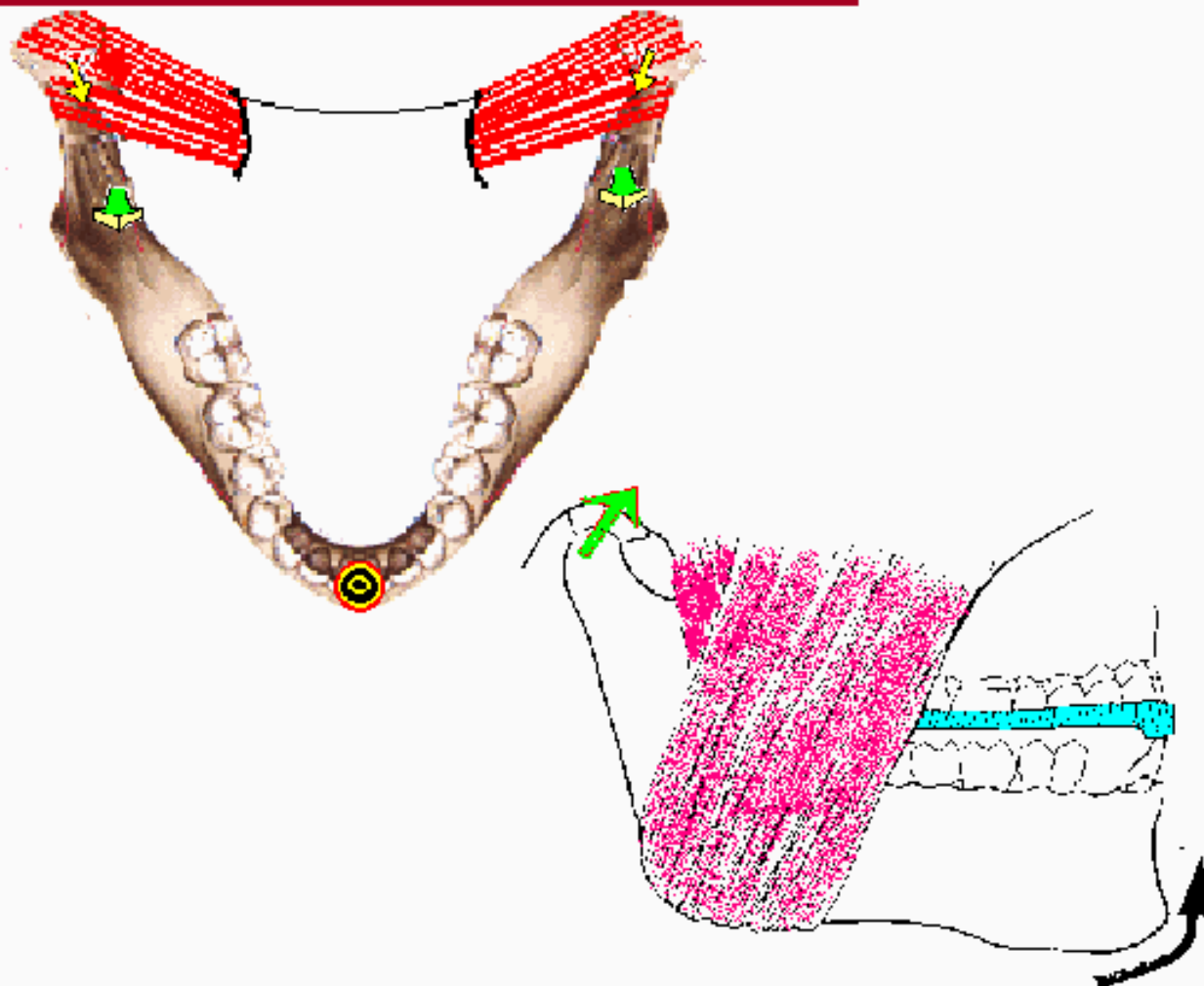
Fabrication technique, retention protocol, and occluding forces prevent dislodgment.

### **Trauma / Intrusion?**

NTI suppression reflex, perpendicular contact, lack of continual contacting prevent trauma or intrusion.

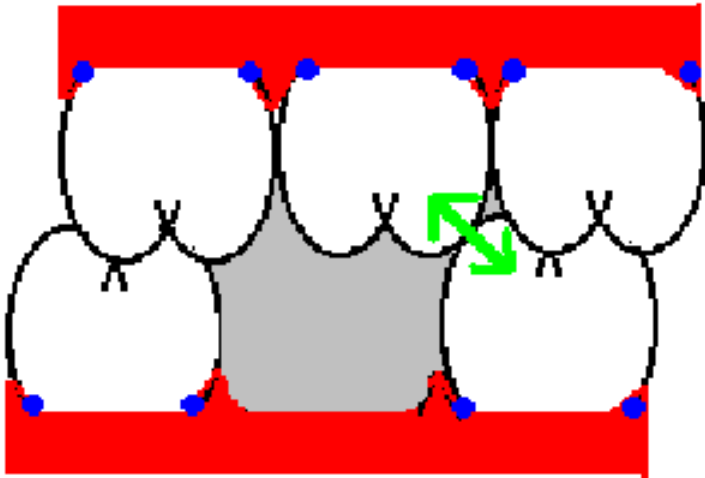
**The NTI does not cause joint strain, but suppresses the muscle contraction intensity and eliminates the occlusal scheme that causes joint strain and/or damage.**

**Minimal strain:** Anterior mid-line contact

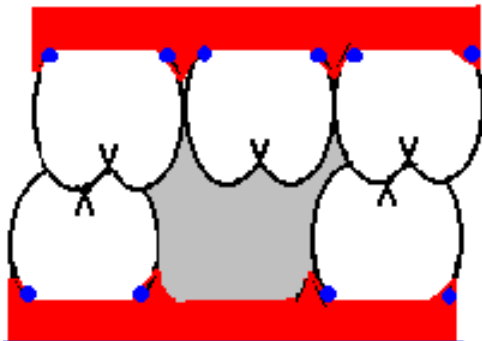


Okeson: Management of Temporomandibular Disorders and Occlusion

# How supraeruption occurs in an adult.

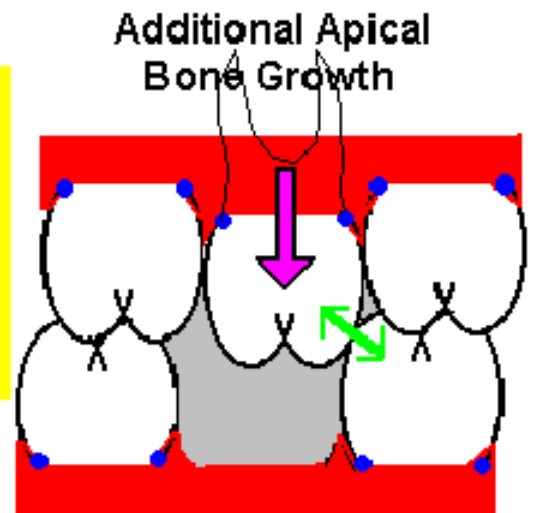


An occlusal stop prevents supra-eruption



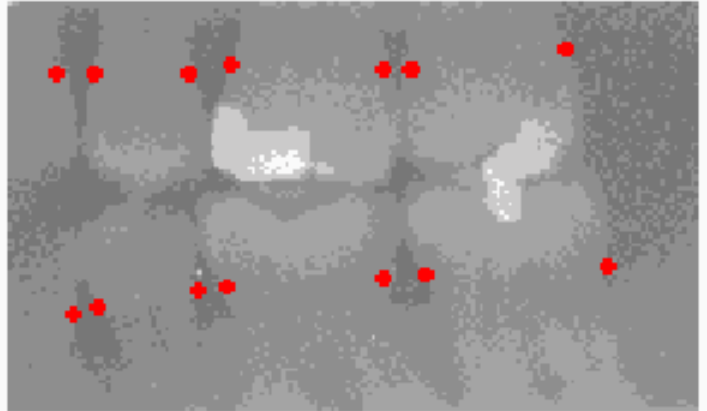
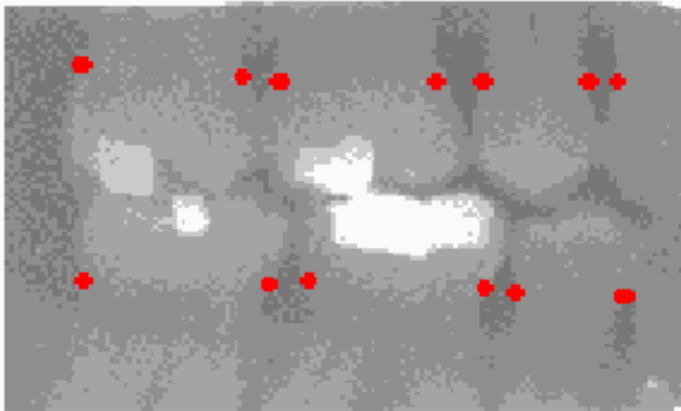
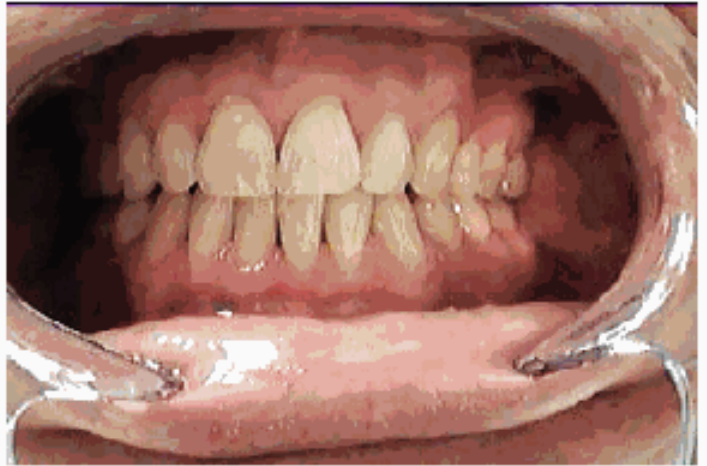
Lack of vertical stop following tooth loss

Apical bone growth results in supra-eruption, requiring a minimum of six weeks.



**Daily masticatory stimulation of the dentition prevents supraeruption.**

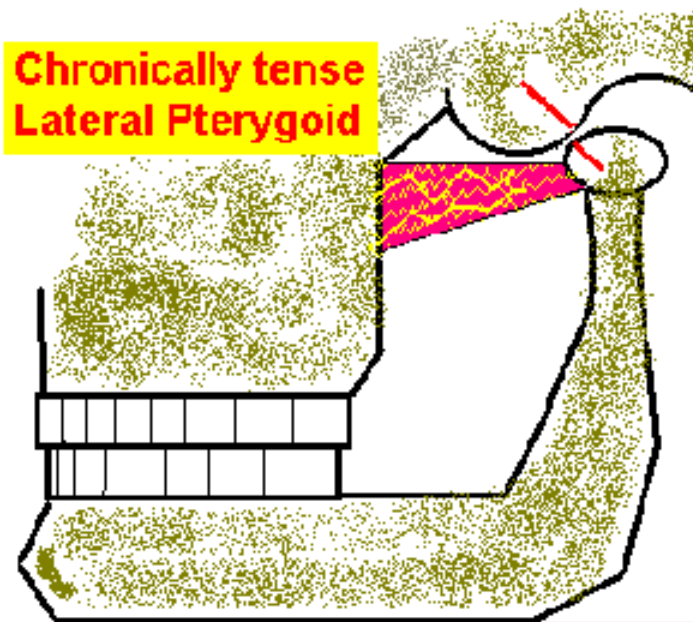
# Long term example (9 years)



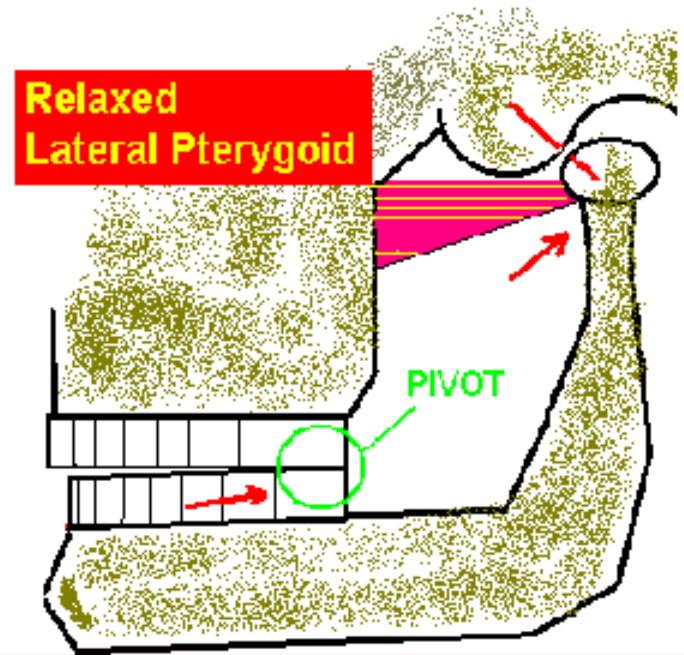
**The red dots on the CEJs would not line up if supraeruption had occurred.**

Following resolution of symptoms, relaxed musculature allows optimum joint position.

## Mechanism for Condylar Repositioning (~5% of cases)



**Tight centric  
Occlusion**

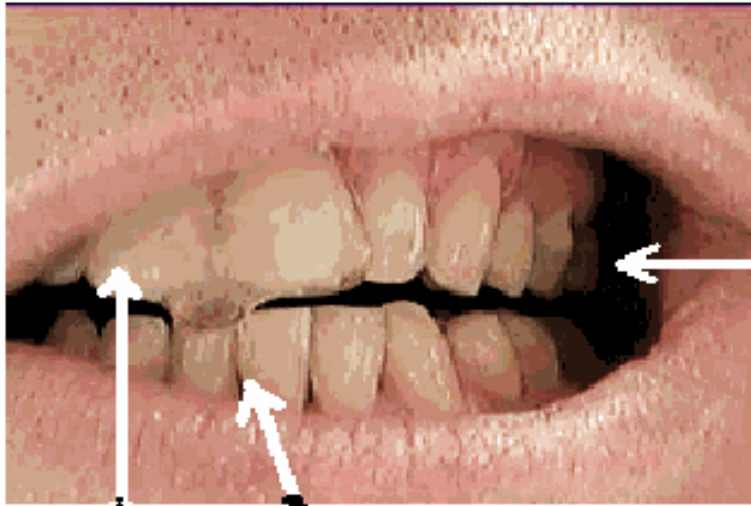


**Condyle seats  
vertically and distally**

If the original condylar position is not optimal, for example, anterior and inferior to the musculo-skeletal CR, repositioning of the condyle necessitates the mandible to pivot at the most posterior molar as the condyle seats into its most optimal position. Depending on the original incisal overlap, this could result in a degree of anterior open bite. Occlusal equilibration is indicated to stabilize the occlusion. *Although clinically this may appear to be supraeruption, hand-held models will confirm that the occlusal scheme has not changed, but jaw relationship has.*

# Inherent Adverse Results?...None.

The *NTI* device is used during *parafunction*, therefore preventing any *functional* adaptation.



**Joint Strain, Disc Trauma?**  
Optimal condylar position & minimal muscle contraction allow joint protection

**Supra-eruption?**  
Daily function and stimulation prevent tooth movement.

## **Aspiration?**

Fabrication technique, retention protocol, and occluding forces prevent dislodgment.

## **Trauma / Intrusion?**

NTI suppression reflex, perpendicular contact, lack of continual contacting prevent trauma or intrusion.

**Intruding of a tooth requires constant apically directed force (clenching events last for only several minutes). Properly fabricated, the NTI "snaps" into place, fitting securely and comfortably. To remove, the patient must make a conscience effort, removing the device in a particular path of insertion and removal**



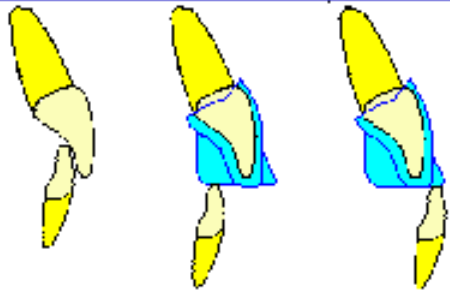
15-minute fabrication and delivery



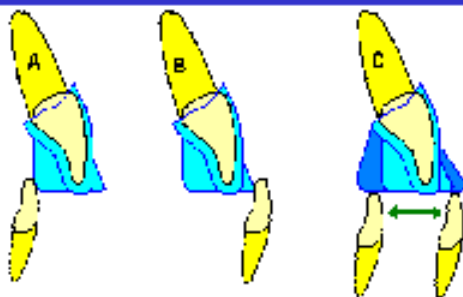
Confirm passive fit... Direct acrylic reline... Sculpt and polish.



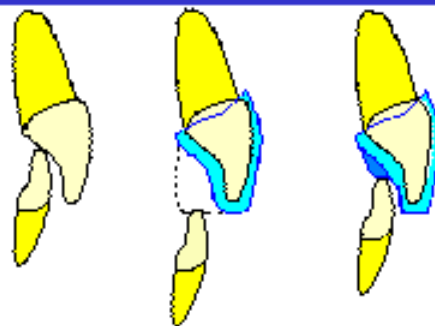
# Adaptations of the *NTI* device:



The standard *NTI* device provides an anterior point stop, perpendicular to the long axis of the mandibular incisors in retrusion and protrusion.

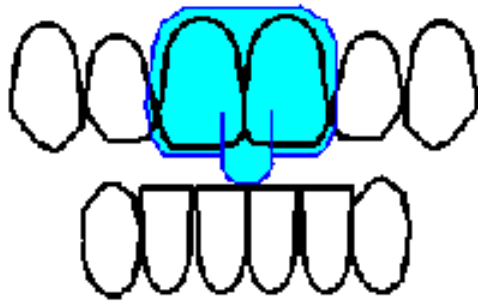


In the event of excessive overjet (A) or extreme protrusion (B), the *NTI* can be easily modified to accommodate (C).

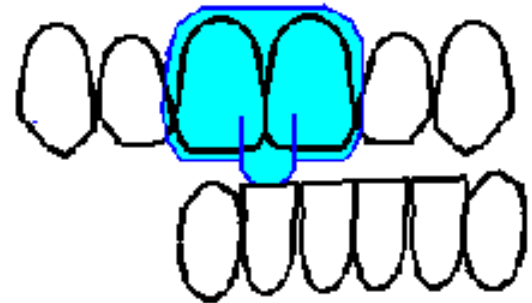


In the event of excessive incisal overlap, the Discluding Element can be customized to accommodate.

## Rationale and Fabrication of “Funneling Excursive Bumpers”



In a centric position with the NTI, clenching intensity is suppressed while joint strain is minimal and condylar position optimal.

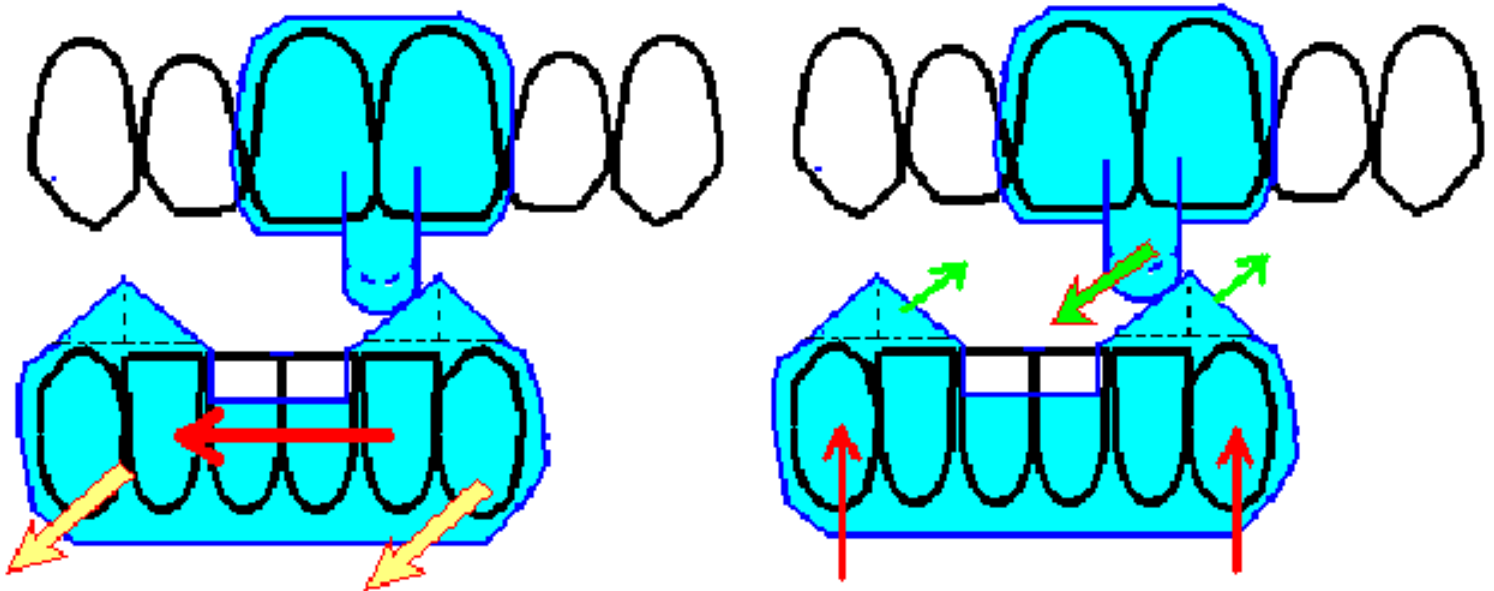


Although clenching intensity with an NTI is not adequate enough to cause a TMD, significant durations of static excursive clenching (“excursive clenching”) can be enough to perpetuate a TMD.

The ideal scenario is to suppress clenching intensity in a stabilized centric position. In order to achieve this, excursive movements must be restricted *without providing increased resistance to excursive movement (lateral pterygoids)*.

The NTI kit contains "universal" devices, from which "Funneling Excursive Bumpers" can be made for the lower incisors. The F.Ex.B.'s re-direct the vertical clenching forces, bringing the mandible back to center.

## "Funneling" vertical forces guides the mandible back to centric:

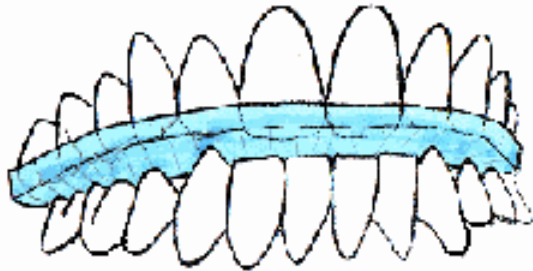


During excursive movement (or in a relaxed state, such as when sleeping on one's side), clenching intensity is diminished (which "allows" the movement). The ramp of the F.Ex.B. will slide "down" the side of the NTI's D.E....

...When clenching resumes, the ramp of the F.Ex.B. exploits the vertical forces and "funnels" the D.E. back to a centric position.

Fabrication of the F.Ex.B.'s are time consuming and technique sensitive, compared to the fabrication of the NTI. When done properly (for example, failure results when a crest of a F.Ex.B. can occlude with a maxillary tooth, thereby allowing clenching intensity to \*increase\*), the combination of an NTI and F.Ex.B. is extremely effective.

## **Splint / Nightguard** vs.



**1<sup>st</sup> visit:** Impressions & models  
(send to lab / process in house)

**2<sup>nd</sup> visit:** Deliver and adjust

**3<sup>rd</sup> visit:** Re-eval & adjust

**4<sup>th</sup> visit:** (Adjustment)

### **Expense to dentist:**

Typical laboratory fee;

>2 hours total chair-time

**1<sup>st</sup> visit:** Fab./deliver (<30 min)  
(can be done by assistant)

**2<sup>nd</sup> visit:** Re-eval (& adjust)

### **Expense to dentist:**

**<1/3 the typical laboratory fee**

**<1 hour chair-time**

## **Contra-indications for the use of the NTI Clenching Suppression System**

**An anterior midline point stop (as provided by the NTI) has been shown to decrease (suppress) muscle activity, and allow the optimum musculoskeletally stable (anterior-superior) condylar position. In the event the patient's condylar position is not optimal, the patient's condyle may re-position more anteriorly during resolution of their symptoms. This may result in a change of the patient's occlusal scheme. Although this is not a result of "supraeruption", it may appear that way, due to the mandible pivoting at the distal most molar, possibly creating a lone contact (which can be adjusted through equilibration).**

**This fact should be pointed out to the patient. If they do not consent to the possibility of a change of occlusal scheme (even though symptoms have improved), this device is CONTRA-INDICATED.**

**In the presence of advanced periodontal disease, the NTI is contra-indicated.**

**Not all occlusal schemes are compatible to the application of an NTI device without significant modifications to the device, such as in the case of severe flaring and/or rotation of the central incisors.**

**Following any apical or alveolar surgery to any of the teeth that support the NTI, discontinue use until completely healed.**

**In the event of severely worn centrals (for example, a loss of 50% of tooth structure) the nighttime NTI is contraindicated, due to lack of available undercut for retention. Utilization of the universal device may be adequate (with custom application of a discluding element), so long as adequate retention can be achieved.**

**If the patient insists on a "more comfortable" fit, that is, not as snug, confirm that the patient CAN NOT remove the NTI without using their hands. The NTI is contra-indicated if the patient is non-compliant with the appropriate retentive adaptation.**

**Discontinue use if the supporting teeth have provisional restorations.**

**The NTI can not be placed in the presence of orthodontic brackets.**

**If the discluding element is not perpendicular to the long axis of the mandibular incisors, or wedges into a diastema, the NTI is contraindicated unless modifications are made.**