



(Nociceptive Trigeminal Inhibition  
Tension Suppression System)<sup>®</sup>

## **User's Guide**

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# NTI-tss® User's Guide

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## NTI-TSS, Inc.

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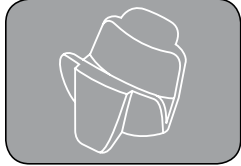
More information or technical assistance can be obtained by calling  
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## NTI IMPORTANT INFORMATION

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### NTI DEVICES, INTERNAL IDENTIFICATION MARKINGS AND GENERAL GUIDE TO USAGE:



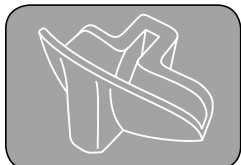
**Incisal Guidance (IG) Mandibular Device** (*IGR or RV2*)  
 Primarily intended for the mandible, the Incisal Guidance (IG) is typically the “default device.” The Discluding Element has been “pre-reduced” in vertical dimension, extended labially for potential excessive overjet, and is tapered to the lateral borders of the device, thereby providing for smooth excursions. This device is quickly becoming one of the most commonly used devices.



**Reduced Vertical Maxillary Device** (*RV1*)  
 The Discluding Element has also been “pre-reduced” in vertical dimension, as well as shortened labially. The labial wall has also been reduced in thickness. Primarily intended for the maxilla. Resembles a Standard Device that has been fully modified.



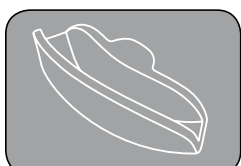
**Standard** (*STD*)  
 For general purpose modification. The Standard is typically altered by the practitioner to provide proper vertical dimension (minimal freeway space) and horizontal Discluding Element orientation to provide for the greatest anterior-posterior movement without increasing VDO during the movement.



**Standard-Wide** (*C*)  
 Provides additional retention by being extended laterally. For example, when the incisors have been significantly shortened, or when their profile is too “flat,” or when an incisor is missing.



**Daytime** (*B*)  
 For the patient who may require reduction of daytime activity, or as an opposing “slidebar” to another NTI device on the opposite arch. A thin labial wall and minimal lingual Discluding Element allow for less conspicuous daytime use.



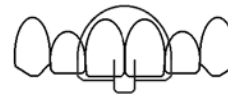
**Universal** (*UNV*)  
 Also for general purpose modification. Can also be used as a Daytime Device, or a sturdier “slidebar” over the opposing incisors.



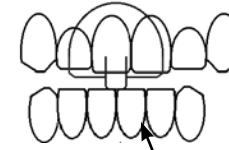
**IG-Wide** (*IGW*)  
 This wider version of the Incisal Guidance (IG) Mandibular Device enhances retention. The thicker Discluding Element provides additional strength and vertical dimension.

Please note that the lettering next to each device name above allows for easy identification when working with the NTI devices in your practice. These marks are found in the trough of each device.

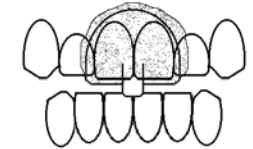
## Quick Start Guide and Important Insights When Using the NTI-tss® With SNAP™ Materials



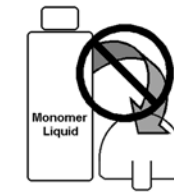
Confirm a passive fit over the mandibular or maxillary incisors before the device is relined. Reduce the internals of the device where necessary to allow full seating (the palatal internal line-angle may need altering).



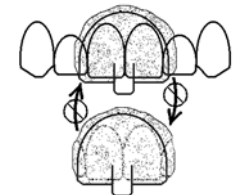
Align device over the opposing midline upon closure. **Position the device laterally if necessary.**



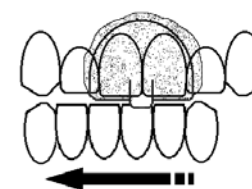
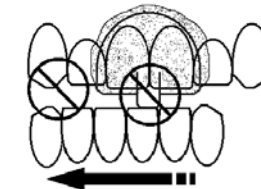
It is preferable to have the patient bite on the Discluding Element during initial 2-minute cure. This will help to ensure a comfortable orientation to the opposing incisors.



Never condition the internal of the device with monomer or create a too wet or runny mixture of acrylic. Doing so will allow the device to fracture. Allow the acrylic mixture to be in a doughy state before relining device and seating.



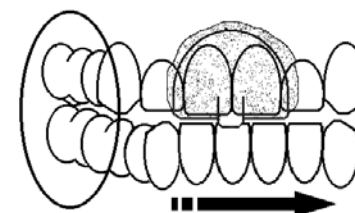
Do not pump the device on and off during the first 2 minutes. Remove and set aside to fully cure and then trim internals to create a snap fit (pumping jams the interproximal acrylic into the papillas).



Always check to confirm that the Discluding Element has not created too much opening (left). Reduce the Discluding Element as necessary to create normal freeway space and minimal clearance between canine cusp tips in excursive (right). Allowing for too much vertical opening in excursive can strain the joint and symptoms may persist or increase.



In the event there is an approximately greater than 50% incisal overlap, the Discluding Element may be ramped to allow for the appropriate disclusion freeway space.



Confirm that in excursive movement there are no posterior contacts. A palatal cusp may be able to contact a lower distal buccal cusp.

The patient may not be able to do this upon initial delivery. Within several days to a few weeks, normalization of the musculature and seating of the condyle may allow for this contact.

A 2 week re-evaluation appointment is advisable to make any needed adjustments.

Do not increase vertical by adding to the Discluding Element, but reduce the opposing cusp tips.

## FREQUENTLY ASKED QUESTIONS

### Can the NTI-tss® cause posterior supra-eruptions of the teeth or anterior intrusion?

Since the patient cannot wear the NTI-tss device while chewing food, the posterior alveolar structures receive regular stimulation every day; therefore, there is no opportunity for a functional adaptation of the occlusal scheme, that is, supra-eruption of the teeth. Research shows that alveolar bone requires at least 8 days of lack of stimulation before bone growth at the apex (supra-eruption) can initiate. As for anterior intrusion, the lack of continuous apical force does not provide adequate opportunity to intrude on an incisor. However, changes in the jaw relationship can be observed within 8 days (which is identified as a change in the occlusal scheme), and is a result of the normalization of the musculature (See Anterior Open Bite Development page 17).

### Isn't the NTI-tss only indicated for clenching patients?

The NTI-tss is indicated for all types of TMD. The only way any musculature of the head and neck can contract with significant intensity is to have either canine or posterior teeth (or both) in occlusion. It is the occluding of these teeth which allows the musculature to exert strain on the alveolar structures, TM joints, and sphenoid bone (pterygoid plates). Without the occluding of these teeth (ie, rest position), these structures stand the best chance for healing and remodeling. Therefore, the NTI-tss is ideal for all types of TMD and MPD patients.

### Is there a patient for whom the NTI-tss clearly would not be effective?

Assuming the patient has the adequate dentition to support the NTI-tss matrix, the NTI-tss will be effective in the presence of muscular parafunction. A lack of effect can be used as a diagnostic rule-out method (assuming protocol was followed with no oversights).

### Are there age restrictions for treatment with NTI-tss?

While every dentist has certainly heard parents complain of very young children who grind their teeth while sleeping, the standard NTI-tss device is best suited for permanent teeth. However, for children without permanent teeth who are symptomatic resulting from muscular parafunction, a custom fabrication of an NTI-tss type device can be used.

### How long should a patient expect the NTI-tss device to last?

The duration of the NTI-tss device is dependent on the intensity of the patient's grinding, not clenching. If a patient is an intense grinder, over time the patient may develop a divot in the Discluding Element (DE) of the NTI-tss. This situation would simply require periodic filling and smoothing of the divot (See Fill the divot page 14).

### Does insurance cover the cost?

Some dental or medical insurance plans may help pay for the service, but all plans are different. The same insurance codes for mouthpieces, splints, and TMD devices all apply to the NTI-tss. Coverage should be discussed with patients, with respect to their individual insurance plans (See Insurance Billing page 20).

### What if the patient complains of pain in the opposing anterior teeth?

If after a brief wearing period, the patient complains of pain in the opposing incisors, the DE is either not in a tolerable orientation to the long axis of the opposing incisors or a posterior contact in an excursive position is allowing re-establishment of clenching intensity, thereby traumatizing the lower incisor. Adjusting the orientation Discluding Element (by altering the Discluding Element or relining the matrix) or reducing the posterior cusp interference will readily reduce the strain and discomfort.

### How soon should the patient expect to see the presenting symptoms subside?

Subsiding symptoms are directly related to the degree and longevity of each individual's condition. However, it is not unusual for some patients to report significant relief overnight; others usually within one to several weeks.

## PROTOCOL SEQUENCE FOR MIGRAINE, HEADACHE, AND TMD PREVENTION

### I. Patient Interview

- A) Casually ask the patient, "When you wake up in the morning, do you feel fabulous?" This obviously is a curious and unusual question. If the patient hesitates and then begins to rationalize an answer, provide the patient with a Headache History Questionnaire
- B) If patients have mentioned migraine pain, confirm they have had a medical workup.
  - 1) If they have consulted a physician regarding their headache pain, and have been diagnosed with either migraine, tension-type headache, or mixed headache (migraine + tension-type), proceed with treatment.
  - 2) If they have not consulted a physician and have been suffering for over 1 year (no recent noticeable changes in symptomatic presentation), record in the chart that you recommend the patient have a medical workup, and proceed with treatment.
    - a) If the patient has been suffering for less than 1 year, and has not consulted with a physician for a medical workup, discontinue treatment and refer the patient for a medical workup.

### II. Muscular Palpation

- A) Standing behind the seated patient, the practitioner should press firmly with his/her index finger on the patient's forehead at the midline while asking the question: "How much does this hurt?"
  - 1) It should not be painful (although it may be tender or sore). This is the control for comparison. Without this first step, the rest of the exam could be dismissed by the patient, who might say, "Well of course it hurt (what you're about to do below), you're pushing so hard!" A chronic headache/migraine sufferer has no normal to compare to.
- B) Palpate with an index finger the patient's anterior temporal area. Using a massaging motion, locate a fibrous band and press just as firmly on it as was done on the control.
  - 1) The typical appropriate candidate will report significant discomfort.
- C) If less-than-significant discomfort was reported, continue palpation and press firmly on another fibrous band. Areas that are painful during palpation may be only a few millimeters laterally to an area that was without discomfort.
  - 1) If muscle tenderness is absent, confirm with the patient the type of headache he or she experiences. The frontal/sinus headache and back-of-the-neck headache result when the patient is a protrusive clencher, which is less strenuous on the temporalis (thus, the lack of palpable tenderness), but fatiguing to the lateral pterygoids (static protrusive pull) and the trapezius at the base of the skull (for balance during protrusive thrust). Wear facets on the incisors may be obvious. Casually inquire regarding any history of sinus conditions and stiff and sore neck. Since the dentition must be engaged to maintain protrusive clenching, an NTI-tss device is indicated.
    - a) Continue with the usual complete muscular exam as you would for a TMD/MPD patient. Take particular note of the tender (often painful) palpations at the insertions of the trapezius at the base of the skull (usually will be consistent with sinus conditions and incisal wear).

### III. Identifying the NTI-tss candidate (any combination, or just one)

Wakening with some degree of headache, face, neck or jaw discomfort is NOT unusual; prior treatments have been less than successful at preventing the symptoms; temporalis palpation reveals a degree of discomfort, or sinus conditions with a stiff and sore neck; typical presentations when an occlusal guard is indicated.

### IV. Fabricate and deliver an NTI-tss (used always while sleeping, never during function)

- A) Confirm no oversights.
- B) For best results, fabricate and deliver a daytime NTI-tss (to be worn as often as possible, never when eating, for 6 to 8 weeks).
- C) Have patients fill out consent form, and go over it with them.

## MIGRAINE PREVENTION PROTOCOL (DAYTIME DEVICE)

### V. Re-evaluation

- A)** Appoint the patient for evaluation in 2 weeks. Advise the patient that this appointment is not intended to evaluate any degree of improvement, but to provide whatever modifications are necessary. (The patient may report the device seems loose. It would not be unusual to need to reline the NTI-tss® with a thin lingual wash of acrylic. This is most likely the first and last time a reline will be necessary.)
- 1) In a short period of time (easily within 2 weeks), the patient's mandibular range of motion may have improved considerably. Although this is a sign of improvement, it may have also allowed the patient's muscular dysfunction to form a method to defeat the device (that is, methods of occluding the teeth may now exist that did not 2 weeks prior). Confirm the circumstances covered in *Oversights*, especially if there has been no change in patient symptom presentation. (Although it may be too early for patients to begin making conclusions regarding migraine, they may be aware of other changes. Engage patients in a discussion regarding their overall condition. Often times, they reveal information critical in your treatment success, but have no idea the information would be important to you.)
- a) While reviewing the patient's Headache History Questionnaire (don't let him or her see it), ask some of the same questions, but confirm with the patient that these questions now refer only to the last 2 weeks. The patient may dismiss any improvement over the first 2 weeks of treatment as coincidental and therefore unremarkable.
- B)** If there has been unremarkable improvement within the first 2 weeks, reappoint the patient for a re-evaluation at the 6th week.
- 1) Patients may report, "I'm still having headaches." Review the Headache Questionnaire. Ask them what time of day the headaches start. Patients may report that they start early in the day, or soon after lunch, while the original report (in the Questionnaire) states that headaches usually start soon after or upon awakening. This may be an indication for the daytime NTI-tss, or evidence of the patient's lack of compliance with the daytime NTI-tss. (Don't be too hard on patients if they've not worn the daytime NTI-tss—be as helpful and supportive as possible. Perhaps consider making a device for daytime use on the lower teeth.)
- a) The condition may be trying to mislead you!

### VI. Dental Therapy/Restoration

- A)** An NTI-tss is simply a traditional muscle deprogrammer but its simple yet profound modifications allow it to be used therapeutically. The NTI-tss will provide the exact same results as would be expected when using a muscle deprogramming device:
- Reduced muscular activity
  - Optimal seating of the condyle
  - Protection on the dentition
- 1) Following the application of the NTI-tss, the patient's condyles may have seated optimally while parafunction intensities have been controlled. The need for dental restoration and therapy may be apparent. For some patients, the use of the NTI-tss is the entire treatment. For others, it allows for the initiation of occlusal treatment.
- a) Following dental restoration, the patient may still need to wear the NTI-tss nightly, indefinitely, to protect the restorations and to keep parafunctional intensity to a minimum.

An NTI-tss Device should be used for the prevention of migraine and/or tension-type headache reduction only after the condition has been medically diagnosed.

The protocol for delivery of an NTI-tss device for a migraine and/or tension-type headache sufferer is identical to that for the muscular parafunction (bruxism/TMD) patient. However, unlike the bruxism/TMD patient, where the use of a Standard NTI-tss Device during sleep alone is highly effective, the migraine and/or tension-type headache sufferer will most likely require a Daytime NTI-tss Device as well, for the most stable and predictable results.

Although there is little, if any, intense pericranial muscular contraction throughout the day, the presence of an NTI-tss Daytime Device (for the first 4 to 6 weeks of migraine prevention treatment) is essential. Stressful situations (that is, a trigger for a migraine sufferer) can occur at any time. A trigger is really an activation of the patient's sympathetic nervous system. The intrafusal fibers of spindle organs that reside within the fatigued pericranial musculature are innervated by the SNS. Until the musculature has had adequate time to recover from its chronic intense nocturnal parafunction (4 to 6 weeks with regular nighttime NTI-tss use), the intrafusal fibers of those spindles still reside within fatigued, dysfunctional musculature and may hyper contract. This is highly painful and may be the source of the migraine pain.

The presence of a Daytime NTI-tss allows patients to gently tap their opposing incisors on the Discluding Element throughout the day and during stressful events, thereby exploiting the nociceptive trigeminal inhibition (NTI) reflex, which serves to suppress and relax the pericranial musculature. This may disrupt the neuromuscular mechanism leading to the migraine pain.

A Daytime NTI-tss is not necessarily the same as the patient's standard Nighttime Device. Since parafunctional excursive and protrusive activity during the daytime is insignificant, the degree of vertical opening and anterior extension of the Discluding Element can be reduced for the patient's comfort (it especially should not act as an irritant to the patient, thereby becoming a trigger itself!). A Daytime Device would ideally provide minimal posterior disclusion in centric and in slight excursive movements.

In moderate excursive or protrusive movement, canine or posterior teeth may be able to contact each other (unlike with the Standard Device), allowing for the perpetuation of temporalis dysfunction if patients were to wear the device while asleep. These potential contacts would provide for intense muscular activity, making the daytime design contraindicated for nighttime use. If patients complain of new symptoms during the day following daytime use, it is most likely due to daytime excursive activities that they are not aware of. If so, increase vertical slightly if tolerated.

A Daytime NTI-tss is recommended for at least the first 4 to 8 weeks of preventive treatment for the migraine and/or tension-type headache patient (in addition to use of a Nighttime NTI-tss), to be worn at all times, except for when eating. Following that time, daytime use is optional for the patient. As long as the patient continues to remove the Daytime Device while eating (which provides alveolar stimulation, thereby preventing posterior supra-eruption), there are no adverse dental effects. As the nocturnal parafunctional intensity continues to be suppressed night after night, the ability to trigger a migraine during the day decreases. After 6 to 8 weeks, the Daytime NTI-tss is no longer necessary, because the pre-existing condition (which was being perpetuated by nightly activity) of pericranial spindular dysfunction no longer exists.

The need for occlusal equilibration may become obvious during this time. When the patient removes the Daytime Device, the patient may be aware of occlusal interferences that had gone previously unnoticed due to dysfunctional musculature. These are SNS irritants as well and should be equilibrated. Otherwise, patients will find themselves always wanting to wear the Daytime Device (because their teeth may feel awkward if equilibration is warranted but not completed).

## HEADACHE HISTORY QUESTIONNAIRE

1. On a scale of 1-10, with 10 being the worst pain imaginable above the shoulders, how many mornings per week do you wake with 0 pain?
2. On a scale of 1-10, what's the average number you usually wake with?
3. What percent of your waking time do you have some degree of headache?
4. What percent of your waking time do you have a 0 without taking medications?
5. What is your average headache pain level (1-10 scale) throughout the day?
6. On a scale of 1-10, what is the worst pain level you experience?
7. What time of day do you usually experience your worst headaches?
8. How many times per week (or month) might you experience your worst pain?
9. Where does your pain seem to originate?
10. How would you describe your pain?  
(Examples: throbbing, squeezing, pressure, dull, stabbing, shooting, etc.)
11. Please circle the types of health care providers you've seen for your headaches.  
MD Neurologist ENT Internist Physical Therapist Chiropractor Dentist  
Others: \_\_\_\_\_
12. What medical tests have been performed regarding your headaches?  
CT scan MRI X-ray Blood analysis Other: \_\_\_\_\_
13. What types of procedures/treatments (including dental) have you had for headaches?
14. What medication(s) do you now take to prevent your headaches?
15. What medications have you tried to prevent your headaches?
16. What prescription or over-the-counter medications (and how much) do you take to relieve your headaches?
8. This is usually what they report to a physician, and may have been interpreted as how many headaches per week (or month) they have, when it simply indicates how intense their (nearly) ongoing discomfort can get. For example, if the response was "5 times per month," you might reply: "If your worst headache lasts for 2 days, then that is up to 10 days per month. Does that mean you have a zero the other 20 days per month?"
9. The position of the mandible during the muscular parafunction events dictates the origin of the discomfort. Examples—Bilateral temporal pain: centric clenching; Unilateral temporal: unilateral clenching; Frontal (sinus) with neck symptoms: protrusive clenching; Facial and TMJ: excursive clenching—or alternating combinations.
10. This is a rule out type of question. Terms which DO NOT comply with myofascial pain (examples: shocking, jolting, knife-like) should be investigated further by a physician.
- 11-13. Confirm you are NOT the first provider the patient has consulted regarding headaches. If you are, and the patient has been having the headaches for less than 1 year, *insist the patient see a physician for a complete workup*. If it has been more than 1 year, note in the chart that you recommend a full medical workup.
- 14-16. Do not recommend the patient change any medications. Note that most preventive medications are taken before bed. If following NTI-tss therapy the patient's symptoms decrease significantly, have the patient consult with the prescribing physician regarding the necessity of the preventive medications.

As you review the questionnaire responses and listen to the patients' comments, imagine if what they describe could be caused and/or perpetuated by highly intense nocturnal clenching, and what type of clenching activity might be required to relate to their responses. There is nothing normal about the activities you'll be imagining. In fact, you might think, "That would be pretty weird if they were to do that..." which is exactly the point. The patient in front of you has most likely been given a clean bill of health, yet is miserable. What they are doing must be pretty weird for them to be where they are.

Also, patients may tell you things that they think you want to (or might need to) know. They may provide what they think are insights or suggestions. Something to consider always: Imagine the patient has been possessed by the muscular parafunction animal. Sometimes, the animal is speaking to you through the patient. It is trying to mislead you. It does not want to be disturbed. For example, the patient might say, "I feel that my bite is off," or "I can't find a place where my teeth are supposed to come together." The animal is trying to convince you that you should improve the occlusal scheme. Why? Because that would make the animal a better clencher (See *Interpreting Patient Responses*). At this moment, remind the patient: "You see! The condition is talking to us! It wants to keep on with its activity. Why would you comment that your bite was off or needed to be improved if you weren't biting frequently?"

## RATIONALE FOR QUESTIONS

- 1-5. The goal is to confirm a foundation for the headaches. There is nothing normal about waking with any degree of discomfort, although a majority of chronic headache sufferers accept a tolerable degree of discomfort *as acceptable and unremarkable*. They have succumbed to the regular pain, and report only their most intolerable pain. Their rationalization for their various presentations of discomfort is a diagnostic trait of the chronic sufferer.
6. This is what the patient is most concerned with, and what previous treatments have aimed to prevent. Confirm with the patient that this is your goal as well as to prevent the worst pain and the causative, perpetuating activity that creates the foundation.
7. The patients who have severe afternoon episodes usually have more frequency and duration of muscular parafunction throughout the day (although not nearly as intense as nocturnal activity). Although the answer may be "sometime in the afternoon" (and therefore the patient's focus), they still have discomfort at other times of the day. Those who report more severe afternoon episodes have a greater necessity for a daytime device (See Migraine Prevention Protocol page 5). Patients reporting the most severe episodes upon waking or in the morning (some will report they are awakened from sleep) may have less of a necessity for a Daytime Device.

## PATIENT CONSENT FORMS

As part of any good dental practice, we know you regularly use a Patient Consent Form. From time to time, we get questions about what additional things might be added to your existing form as it relates to the NTI-tss®. There is a sample consent form on our web site at: <http://www.nti-tss.com/Owner-Manual.pdf>. Use this as a guideline and alter the questions as they might pertain to your practice. We strongly encourage you to review these sample questions just to make sure your patient knows what they can expect with an NTI-tss device.

In addition, it is critical that every patient who leaves your office with an NTI-tss device also be given the Important Patient Information pamphlet, which is included in every NTI Kit. Each kit includes one pamphlet for each device. This will insure not only that the patient knows how to properly care for the NTI-tss device but will also make them aware of things they should watch out for as they continue to wear their device. If you have misplaced them or need more, please feel free to contact us at the Order Hotline for additional Important Patient Information pamphlets at no charge.

### NTI-TSS SAMPLE CONSENT FORM

*Kindly initial each item as you read and understand it. Please feel free to ask us if you have any questions.*

- \_\_\_ Wear the appliance(s) *continuously* (except when eating) for the first four weeks (if you have one for sleeping and one for waking). Sleeping use may continue indefinitely, while daytime use will eventually be tapered off to, at most, stressful situations.
- \_\_\_ Never wear an NTI-tss appliance while eating. (Doing so may be painful and possibly damaging to the opposing teeth.) Discontinue all gum chewing even when not wearing the NTI-tss. Your dentist may also ask you to avoid chewing hard or rubbery foods for some time. Note: use your container when you take out your NTI-tss and don't wrap it in a napkin. We have to charge for lost appliances.
- \_\_\_ Avoid sleeping on your stomach. Sleeping on your stomach forces your head to be turned to the side, which may allow significant muscle strain.

NTI-tss use should temporarily be discontinued (and adjusted by your doctor):

- \_\_\_ If it is uncomfortable, too tight or binding, too loose (can be removed with your tongue or lips), or damaged.
- \_\_\_ If, when wearing the NTI-tss, your back teeth or canine (eye) teeth can somehow touch each other in various jaw positions, or if you notice an obvious notch or divot where your opposing teeth contact the device.
- \_\_\_ If you notice that your teeth are no longer coming together as they did prior to NTI-tss use. This is an indication that your jaw is re-aligning. Although this is usually a good sign and occurs as symptoms have resolved (or are resolving), the improving alignment of the jaw may be undesirable without some type of modification to the teeth. Otherwise, you may continue to have jaw pain, headache, or damaged teeth.

*Patient understands that:*

- \_\_\_ The NTI-tss suppresses muscle dysfunctions and is not an orthodontic appliance which can move teeth. Daily chewing (without wearing the NTI-tss) will maintain each tooth's original position. Those familiar with any type of removable custom mouthpiece realize that a mouthpiece may fit poorly if it has not been worn for an extended period. This is due to the constant slight adjustments teeth make to the forces around them.
- \_\_\_ Pre-existing jaw joint noises may not necessarily be indicative of disease or damage, but may also be the body's way of adapting to irritated muscles or injury. The NTI-tss may allow the degree of "loudness" to decrease or resolve completely. Or sounds could increase. Your dentist will recommend diagnostic tests for specific jaw joint disorders.
- \_\_\_ Complete resolution of your symptoms may not occur immediately. Sometimes these bad habits put up a fight (while you're asleep and are unaware)! Typically, the jaw's range of motion improves.

Symptoms may change over time and must be reported to your dentist. Sometimes your dentist must modify the device as the condition adapts and attempts to defeat the NTI-tss.

- \_\_\_ Reducing jaw muscle tension may allow the jaw joints to achieve their most natural, relaxed position (if they weren't in that position to begin with) and allow the jaw to close in its best and most natural path, *which may be different from what the patient originally started with*. This is considered a diagnostic event, and while it is not a common occurrence, it presents as symptoms are relieved, demonstrating that your jaw joints had not been in their ideal positions. There is no test to determine in advance if the jaw joints are in their ideal positions.
- \_\_\_ One example of an improvement in jaw relationship results in the farthest back molars contacting before the other teeth do, while the front incisors may not contact as well as they did before (or in rare cases, may not be able to touch each other at all). In this event, your dentist may recommend modifying your teeth to achieve the most efficient closure (or bite). This may be done by various therapeutic combinations which may include re-shaping the teeth, adding to them with fillings or caps, moving them by orthodontics (braces), or surgery.
- \_\_\_ Part of the historical Standard of Care in dentistry for jaw related conditions has been to provide a full coverage mouthpiece. These appliances cover all of the upper or lower teeth and are intended to deflect, absorb, or modify the forces generated by muscle clenching or tooth grinding. Unfortunately, these appliances can also allow for the intensity of bad habits to *increase*, by simply providing a more efficient surface to bite on. The NTI-tss appliance is specifically designed to suppress muscle bad habits.
- \_\_\_ Clean your device after each time you wear it. To clean the device, rinse with cool water. **DO NOT USE HOT OR BOILING WATER UNDER ANY CIRCUMSTANCES—THIS WILL ALTER YOUR DEVICE AND RENDER IT UNSAFE TO WEAR. DO NOT USE A TOOTHBRUSH OR TOOTHPASTE.** Denture cleaner (Polident® or Efferdent®) loosens plaque and helps prevent staining if used to soak your device. Rinse your device well to avoid building up cleaning agents or oral plaque.
- \_\_\_ Keep the appliance away from pets. They may chew on them.
- \_\_\_ The jaw is like a garage door (spring hinge type). Just as the tension of the garage door springs influences the path of closure of the door and its final fit, so does the tension of the jaw musculature influence the path of closure and final fit of the teeth. If one garage door spring is significantly tighter than the other (even though the door may be fitting adequately upon closure), decreasing the tension of that spring will affect the final fit of the door, and may necessitate the modification of the door to ensure efficient closure. Similarly, reducing jaw muscle tension may allow the jaw joints to achieve their most natural, relaxed orientation and allow the jaw to close in its best and most natural path of closure, **which may be different than what the patient originally presents with**. This only occurs in the presence of symptom relief. In this event, your dentist may recommend modifying the occlusal scheme of your teeth to achieve the most efficient closure (or bite).
- \_\_\_ I have read and discussed all the points raised in this advisory brochure and have had all my questions answered to my satisfaction.

\_\_\_\_\_  
Signature of patient or guardian

\_\_\_\_\_  
Date

\_\_\_\_\_  
Dentist signature

\_\_\_\_\_  
Date

This form is available at [www.NTI-tss.com](http://www.NTI-tss.com) in Microsoft Word format, and should be modified to conform to your practice standards.

## FABRICATION AND TROUBLESHOOTING

### Step 1

Confirm that a Standard, Standard-Wide, Incisal Guidance, or Reduced Vertical matrix fits passively over the maxillary or mandibular incisors. While holding the matrix in place, have the patient tap on the Discluding Element several times, so that the mandible begins to reprogram. As the patient gently taps several times, the mandible's path of closure will begin to stabilize and replicate itself. If necessary, position the matrix laterally so that the two opposing central incisors contact the Discluding Element simultaneously upon closure. If the device ends up being off of the incisor's midline, mark the matrix with a pencil line over a landmark (usually the central midline) so that placement during the reline can be easily replicated.

#### *Troubleshooting:*

#### **I. Matrix doesn't seat passively.**

- A) Internal lingual ledge of matrix is binding on cingulum: Reduce its bulk (use laboratory bur).
- B) Incisors are rotated, binding on internal labial or lingual walls: Relieve internals.
- C) Internal lingual ledge is pressing on incisal papilla: Reduce accordingly.

#### **II. Opposing midline doesn't contact on the Discluding Element.**

- A) Reposition matrix (as far to the right or left as necessary) to ensure the opposing midline is positioned opposite the Discluding Element in closure. Afferent signals from the right and left mandibular/maxillary nerve must be as equal as possible (go to Step 2, III).

### Step 2

Confirm the occluding plane of the Discluding Element is parallel to the opposing arch plane, and perpendicular to the opposing incisors. Note: Some occlusal schemes won't allow this. The practitioner may need to relieve the internals of the matrix to come as close as possible, or may elect to place the NTI-tss® on the opposite arch.

#### *Troubleshooting:*

#### **I. Flaring of maxillary incisors doesn't allow for the Discluding Element to be parallel to the maxillary occlusal plane.**

- A) Reduce the internal lingual ledge significantly and rotate the matrix to improve desired orientation.
  1. Reduce the vertical dimension at the distal end of the Discluding Element (grinding away the heel), and possibly add acrylic to the anterior end, thereby rotating the Discluding Element's occlusal plane.

#### **II. In full retrusive or protrusive, the opposing incisors can either get behind or get in front of the Discluding Element.**

- A) Add acrylic to extend the Discluding Element either distally or anteriorly, to ensure the opposing incisors contact the occlusal surface of the Discluding Element.

#### **III. One of the centrals is taller than the other, making simultaneous contact in centric closure not possible. When only one central contacts, the mandible will reflexively attempt to find equilibration, that is, equal input from both mandibular/maxillary nerves. Upon immediate contact with one central, either the patient will report an unevenness or the jaw will immediately shift so as to contact the other central (an excursive movement).**

- A) Reduce the incisal edge of the taller tooth.
  1. Once patients are aware of the discrepancy, they will usually volunteer to have the taller tooth reduced. (They have typically been aware of the unevenness for years, and may see this as an esthetic benefit.)
- B) Fabricate the NTI-tss on the opposing arch.

### Step 3

#### **Using SNAP™ Materials**

In a dappen dish, add acrylic powder to 1 to 2 cubic centimeters of liquid monomer, until the powder is no longer being readily absorbed. DO NOT STIR. Allow mixture to set approximately 30 seconds or until surface sheen changes. Mixture consistency must be thick and doughy.

Load the matrix with ethyl-methacrylate (Parkell's SNAP clear and colorless acrylic for temporary crowns works best) and place over maxillary/mandibular anteriors. **Remove the matrix with a snapping motion at 2 minutes.** Drop into a cup of hot tap water for 30 seconds for rapid final cure, or let set undisturbed for another 4 or 5 minutes to fully cure. Trim the internal embrasures with an Exacto knife, finishing bur, or acrylic clippers, ensuring to leave enough for a snap in and snap out retention.

#### *Troubleshooting:*

#### **I. Hairline fractures appear within matrix, or matrix cracks apart.**

- A) Direct application of the liquid monomer to the matrix will allow it to break apart, while a too thin acrylic mixture allows for the hairline fractures. Do not condition the matrix with monomer. When combining acrylic powder to the monomer, add powder until it no longer is absorbed by the monomer. Let set until it is quite sluggish before loading it into the matrix.

#### **II. Patient reports that the appliance feels tight, or feels as though the appliance is applying pressure to the teeth.**

- A) Assuming that the matrix fits passively over the incisors prior to reline, there is some degree of distortion of the reline acrylic internally, or crumbs of acrylic need to be cleaned out. If after a couple of attempts of relieving the internal lining the patient continues to report tightness or pressure, grind out enough internal acrylic so that the matrix again fits passively. Repeat fabrication Step 3.

### Step 4

#### **Microwave Instructions for the Use of Thermal Plastic for Fitting the NTI-tss**

1. Place approximately 1/2 cup of thermal plastic beads into a Pyrex bowl (microwave safe bowl).
2. Heat thermal plastic in the microwave on high for 1 1/2 to 2 minutes. The white beads will coalesce and turn clear as the material heats. When the material is all clear and relatively homogenous, this is hot enough.
3. ALLOW SEVERAL MINUTES FOR THE MATERIAL TO COOL BEFORE ATTEMPTING TO HANDLE.
4. It is recommended that gloves be worn to handle the material. Get the fingers of the gloves wet. This will help avoid the material sticking to the gloves excessively. If the material is too hot to handle, and it begins to burn your fingers, simply pull off the gloves, and allow the material more time to cool.
5. Once the material can be handled safely, pinch up a portion large enough to fill the matrix of the NTI-tss. At this point the material is also cool enough to begin fitting the NTI-tss.
6. With the thermal plastic seated in the matrix, fit the NTI-tss over the central incisors and leave in place for about 30 seconds.
7. Remove the NTI-tss and trim the excess material off with scissors.
8. Place the NTI-tss in the hot water bath for a few seconds, and smooth the edges with your finger.
9. Replace the NTI-tss over the central incisors, and leave in place for about 1 minute.
10. Replace the NTI-tss and chill in cold water (running a cold tap over the appliance works well). This will allow a small shrinkage of the thermal plastic material, which will allow for the proper "snap fit."
11. Replace the NTI-tss over the central incisors, and check for appropriate tightness of the fit.
12. If the appliance is too tight, place in the hot water bath for a few seconds, replace over the central incisors and remove and replace the appliance several times. This will burnish the material in the undercut areas and allow it to become looser. You may need to repeat this procedure several times. If there is a large diastema, trimming the material between the teeth with scissors may also be necessary.



## ERRORS AND OVERSIGHTS

13. If the appliance is too loose, place it back in the hot water bath until the material is soft again. Remold the material with your fingers, and replace it over the incisors. Leave the NTI-tss® in place for about 10 to 15 seconds, remove and immediately hold under cold water. If this still does not allow the appliance to fit securely, you may need to add more thermal plastic material to allow coverage of more teeth.
14. Normally, the best way to smooth the appliance is to very briefly hold any rough area in the hot water bath, and smooth with your finger. After smoothing the appliance, be certain to place it back on the teeth to ensure the fit is not altered. It is not recommended that the thermal plastic be adjusted with rotary instruments—as the material will melt and gum up the bur very quickly.
15. Finish fitting the appliance by checking the appliance in excursive motions, checking vertical dimension, and other normal NTI-tss fitting procedures.
16. The thermal plastic material is best cleaned with white toothpaste or soap and water. The material will discolor over time. When this happens, the hard material may be separated from the lexan matrix and new thermal plastic can be used to reline the matrix.

### Non-Microwave Instructions:

1. Fill a 15 cc Monoject syringe with thermal plastic pellets.
2. Place the filled Monoject syringe into a bath of boiling water.
3. Allow the material to turn clear and coalesce into a homogenous mass within the syringe.
4. Once the material is clear, remove the syringe from the hot water bath, and allow the material to cool for 1 to 2 minutes.
5. Using the syringe, squeeze enough material into the NTI-tss matrix to fill the matrix.
6. Smooth the material into the matrix using a gloved, wet finger.
7. The excess material in the syringe will eventually harden, and will be ready for use the next time the thermal plastic is needed.
8. Follow steps 6 through 16 above.

An alternative to the above would be preparing several NTI-tss devices in advance, filling the matrixes with thermal plastic. If this is done, you will simply place the pre-filled NTI-tss matrix in the hot water bath, allow the material to reach the appropriate state, and fit the appliance as described.

### Step 5

The finished sculpted and polished NTI-tss will contact the two opposing centrals in a functional arc of closure. In protrusive, the opposing incisors will not be able to get in front of or behind the Discluding Element. The opposing incisors will not be able to get behind the Discluding Element (or even within 1 millimeter of the anterior or posterior edges). Reduce the Discluding Element so the vertical opening is not excessive.

### Troubleshooting:

- I. **Although posterior teeth are discluded in a centric position, there may be posterior occluding in an excursive position. (Typically, a palatal cusp will occlude with a distal buccal or lingual mandibular cusp.)**
  - A) There are two choices. Either increase the vertical dimension by adding a layer of enough acrylic to the occlusal surface of the Discluding Element to provide disclusion, or use the preferable method of reducing the cusp tips of the occluding teeth (this is an obvious demonstration of significant occlusal interferences).
- II. **The tips of the canine teeth can occlude with each other in an excursive position (when the standard NTI-tss is in place).**
  - A) Same as above. However, if the canine cusp tips show no evidence of any occlusal wear, no modification may even be necessary. Presence of canine cusp tip wear is the evidence of excursive canine clenching.

### Excess vertical

By creating too much vertical opening with the NTI-tss, the condyle may experience significant translation during excursive movement, thereby exposing it to excess strain. The patient with too much vertical reports discomfort when clenching excursively with the NTI-tss in place, but is not uncomfortable when clenching in centric. Reduce the height of the Discluding Element as much as possible (without creating canine or posterior contacts) and have the patient repeat the excursive movement. Patients will immediately report a decrease or absence of discomfort. The requirement to suppress muscular intensity is lack of canine and posterior contact, and the requirement for minimal joint strain is minimal (if any) translation. Therefore, the Discluding Element should always be modified to provide only enough vertical opening to keep the canine and posterior teeth discluded when in centric and excursive position.

### Excursive canine clenching

The patient who habitually clenches in an excursive position (usually evidenced by obvious wear facets on the canine cusp tips) *may* be able to clench with a lower canine tooth on the Discluding Element of the maxillary NTI-tss. (However, just because patients can clench a canine on the Discluding Element doesn't mean that they do or will.) If after several days of use, the patient presents with new symptoms, have the patient reproduce the movement of clenching on the Discluding Element with a lower canine. If patients report soreness or stiffness during the act, it is most likely that they are extreme excursive clencher. There are two methods to remedy this. First, decrease vertical dimension as much as possible by reducing the height of the Discluding Element. This allows less translation during excursive movement, thereby reducing the distance of the lateral movement. Second, use a standard NTI-tss on the mandibular incisors, instead of the maxillary. The mandibular movement is usually not adequate to bring the mandibularly placed Discluding Element over to the maxillary canine. Being able to shift the mandibular canine to the maxillary midline is not uncommon; however, the parafunction act of doing so is. Once the modification has been made for the extreme excursive clencher, have the patient attempt to repeat the activity. Where the patient experienced pain upon canine contact just minutes before, the same attempt without achieving canine contact will not produce the same degree of discomfort.

### Excessive protrusion and retrusion

If the opposing incisors can get in front of the bump of an NTI-tss without extreme effort, the chances are that this will eventually happen while the patient is sleeping, causing neck, face and joint discomfort (typically, patients will deny they would ever do such a thing). It is not unusual for patients to be able to do so, even though upon initial delivery they could not. The patient who has lower incisor wear facets, but limited protrusive movement, has been habitually occluding with a restricted protrusive force. Within several nights of using the NTI-tss, their protrusive range of motion may increase considerably, thereby allowing for new (or renewed) symptoms. The Discluding Element should be extended accordingly. Likewise, if the patient is able to get behind the bump, or occlude on the distal line angle (the heel of the DE), clenching forces will be directed in a superior-anterior direction, thereby perpetuating facial and neck symptoms and joint symptoms. Extend the Discluding Element with acrylic as necessary. To confirm that the patient may be getting in front/behind the bump before making modifications that the patient may object to (like making the Discluding Element stick out), paint one coat of fingernail polish on the occluding surface of the Discluding Element. After one to three nights, the opposing incisors will have scraped away the polish, providing a tracing of movement.

### Excessive vertical in protrusive

Although the Discluding Element must be extended as far as necessary, it must not create an increase in the vertical opening as the mandible protrudes beyond the opposing incisors. Doing so strains the joint and symptoms will persist or new symptoms will develop. Modify the Discluding Element to keep vertical opening to a minimum during protrusion by keeping the occluding surface of the labial side of the Discluding Element horizontal (parallel to the floor). Making this adjustment on a patient with joint symptoms will usually provide immediate relief.

### Canine occluding with excessive vertical

In this scenario, an excursive shift allows for canine-to-canine contact with the NTI-tss® in place, with excessive vertical dimension (large freeway space between the posteriors), meaning on the opposite side, the condyle is considerably translated. The more translated the condyle is, the more strain it is subject to. With the canines able to occlude, clenching intensity on the ipsilateral side may persist. The *contraindicated* remedy would be to increase the height of the Discluding Element to disclude the canines, which would potentially strain the contralateral joint in this excursive position. By reducing the cusp tips of the occluding canines and the height of the DE, vertical dimension can be closed to a more therapeutic level. This will decrease the degree of translation of the contra-lateral condyle, and eliminate the resistance utilized by the lateral pterygoid to strain its condyle. Without the canine contacts, clenching intensity is significantly reduced.

### Posterior contact in excursive

Although no posterior contacts in centric of excursive may have been identified upon initial delivery of the NTI-tss (when the device is in place), a posterior contact may present after a few weeks of nightly use. Typically, a condyle will seat into a more posterior/superior position, thereby closing the posterior freeway space on the ipsilateral side. A slight excursive movement may reveal an occlusal interference with a maxillary palatal cusp and a mandibular distal-lingual cusp. Although this may not be evident upon original delivery, the patient may eventually find this mandibular position and continue clenching activity, possibly resulting in an increase in symptoms. At every re-evaluation visit, check for the ability to create a posterior contact with the device in place. Once patients can occlude on a posterior tooth, **THEY MAY REPORT THAT THEIR LOWER INCISORS ARE SUDDENLY SORE** and have unilateral joint discomfort. This is due to the increased clenching intensity that the unilateral posterior contact has allowed. The indicated remedy is to reduce the cusp tips of the interfering teeth (and is easiest to do with the device still in place). Increasing the vertical dimension of the Discluding Element to disclude the interfering teeth is contraindicated. Doing so would simply further translate the strained joint, potentially exposing it to further strain.

### Lack of simultaneous central incisor contact

If upon initial closure the two opposing centrals do not contact the Discluding Element simultaneously, the patient may exert an unconscious effort to equilibrate the forces by shifting the jaw. This is especially evident and an irritant to the migraine patient who is using a daytime device. The unequilibrated contacting on a daytime device can act as an irritant, thereby maintaining sympathetic alert and possibly becoming a migraine trigger rather than a prevention. Either the teeth or the Discluding Element should be altered to allow for equivalent forces on both centrals upon initial contact.

### Fill the divot

In some patients, the Discluding Element will become divoted due to intense excursive and protrusive activities. This can be harmless to a point; however, it may become necessary from time to time to restore the divot back to the Discluding Element's original shape. As the divot gets deeper and deeper, the freeway space between the posteriors and canines in excursive (or centric) becomes less and less, until eventually a contact may exist. The divot will cease to deepen once a contact is made. Typically, symptoms may return shortly thereafter. Simply fill the divot with orthodontic acrylic and polish. The patient need not be in attendance for this and can simply drop the device off at the practitioner's office to be picked up later that day.

### My teeth feel fat (or itchy)

This is due to the re-establishment of normal PDL health. Prior to using the NTI-tss, the patient had been compacting his or her teeth within the sockets on a regular basis. Explain to the patient that it is similar to the tingly sensation one gets after one's foot falls asleep from sitting on it wrong. As the PDL regains its normal state, it can be hypersensitive, creating the sensation of fatness. The sensation will resolve within 2 to 3 days.

### My jaw joint is sore

Typically, this occurs when the Discluding Element has opened the patient's vertical dimension too far. With the NTI-tss in place, have the patient move excursively as far as possible to both the right and left. The direction they hesitate going in (which is uncomfortable) is the direction they go while asleep. Since the Discluding Element has already created a degree of opening, it is also creating an additional degree of translation in excursive movement. Reduce the height of the Discluding Element and have the patient perform the movement again. A decrease or elimination of discomfort confirms that there has been an excess of vertical dimension. Close the vertical as much as possible. Be aware that in doing so, a posterior contact in that excursive movement may present itself, which will need to be reduced.

### I can't close my mouth—I'm always drooling

What the patient may really be trying to say is, "I can't seal my lips together." The bulk of the labial wall should be thinned and blended to as near a knife-edge as possible and extend to a couple of millimeters above the gumline. Reduce the labial bulk of the Discluding Element while allowing for protrusive activity. The primary-clenching patient should be reminded that the assumption that lip-seal is necessary is really "the parafunctional muscular condition trying to fool you into thinking that's so." Many of these patients' clenching habits include a tight lip-seal and create a vacuum within their mouth. When they no longer can do that, they feel that something is wrong, when in fact, what they have been doing is part of the parafunctional disorder (they may need reminding of that). Also, with a new foreign object in their mouth, it is normal for excess saliva production for a period of time. Sculpting the device to make it as natural as possible will help.

### It's too tight on my teeth—I feel pressure

Even though the device may appear to be fitting as it should, if the patient senses any discomfort/disruption, the NTI-tss device becomes more of an irritant to them than a muscular suppressant. The device should feel like a part of their skull, not like an object stuck on their teeth. If an internal adjustment does not rectify the issue, relieve the internals entirely, place it over the retaining teeth and have the patient clench on it. Confirm with the patient that the sensation of pressure/pushing is gone (of course it will be because of the internal relief just performed). Redo the relining procedure, making sure not to remove the device prematurely during curing (doing so may have caused the minor internal distortion that was bothering the patient). Using orthodontic acrylic for the internal relining instead of the acrylic intended for temporary crowns (such as SNAP) can result in a sensation of tightness. It does not have the resilient memory that SNAP does upon initial removal.

### My lower tooth is sore

There are three common scenarios. 1) The orientation of the Discluding Element to the opposing incisors needs to be reestablished, or 2) an incisal corner of an incisor is contacting the Discluding Element in excursive activity, or 3) *A posterior contact exists in excursive movement, thereby allowing increased clenching intensity which traumatizes an incisor.* If while in a centered clench the opposing tooth feels tender or sore, repeat the relining procedure as in the above example. Reorienting the Discluding Element will most likely eliminate the discomfort (it may not look perpendicular to the long axis, but the absence of tenderness or soreness during clenching is more important than how it looks). In the event an incisal corner catches the Discluding Element during excursive activity, attempt to smooth and round off such irregularities, creating as little resistance to the lateral movement as possible. If a posterior contact exists, equilibrate the interference.

## ANTERIOR OPEN BITE DEVELOPMENT

### My teeth have moved

The first assumption that a patient usually makes when normal repositioning and seating of their condyles takes place is that a change in their occlusal scheme has occurred, ie, individual teeth have moved. They are somewhat convinced of this based on their identification of just one tooth that is hitting differently, or their new inability to incise as before. What they are actually reporting is an occlusal interference that their musculature had been adapted to and accommodated for until the use of the NTI-tss®. They should be reassured that without orthodontic intervention, an individual tooth cannot move by itself in a matter of weeks (especially when they perform normal chewing daily) (See Frequently Asked Questions page 2). Ideally, the interference should be reduced (equilibrated) while advising patients that as their muscular condition continues to resolve, another occlusal adjustment may be indicated (See Anterior Open Bite Development page 17).

### I'm still getting headaches

Although the patient's headaches may have been reduced, the patient may change his or her focus from headache reduction to headache elimination. Inquire as to when the patient is getting headaches. Upon awakening? Later in the day? Typically, the patient's morning headaches are noticeably improved, but now the patient focuses on the headaches that come on later in the afternoon. This is an indication for a Daytime Device. In the event the patient has already been provided a Daytime Device, the patient may not be using it (due to the awkwardness or embarrassment) or may be casually performing slight excursive movements to create canine or posterior contacts. If so, modify the Discluding Element or consider making a Daytime Device on the lower teeth. Also, review the protocol for nighttime use, confirming there are no oversights. For a migraineur who has shown little noticeable improvement within the first 2 weeks, consider opening the vertical. Since migraineurs rarely make dramatic excursive movements (they are too busy clenching), the increased vertical opening can serve to disrupt the temporalis' intensity (while other times can serve to activate new activity).

### My jaw is sore after I eat

This is most likely an indication for occlusal equilibration (See *My teeth have moved*, above).

### My speech has changed

As the muscular condition resolves and the mandible assumes its most musculoskeletally stable position, the patient's speech and diction may change. The new jaw position and occlusal scheme may not allow them to create the same sounds as prior to using the NTI-tss. This is usually accompanied by a reduction in symptoms. Occlusal equilibration may be indicated.

### My headaches are better, but my neck and shoulders are still sore

The reason the NTI-tss works so well and quickly on face, jaw, and head pain is that it directly suppresses the intensity of the muscular activity responsible for those pains. Keep in mind that muscular activity has three components:

- Frequency of acts
- Duration of a given act
- Intensity of the act

The NTI-tss can only suppress the intensity of an act, which has a direct effect on certain muscles and an indirect effect on others. The musculature in the neck/shoulders continues to parafunction with the same frequency and duration as before... but now to a lesser intensity, due to the elevating musculature's decreased intensity. It is not uncommon to have a patient report: "Wow, my headaches were helped right away, but my neck and shoulder discomfort seemed to slowly improve. After a couple of months, I noticed it wasn't anywhere near as bad as it used to be!"

### My headaches are back

Consider increasing vertical for the primary clenching patient, check for new occlusal contact, or fill the divot if one is present.

### As stated in the Sample Consent Form:

The jaw is like a garage door (spring hinge type). Just as the tension of the garage door springs influences the path of closure of the door and its final fit, so does the tension of the jaw musculature influence the path of closure and final fit of the teeth. If one garage door spring is significantly tighter than the other (even though the door may be fitting adequately upon closure), decreasing the tension of that spring will affect the final fit of the door, and may necessitate the modification of the door to ensure efficient closure. Similarly, reducing jaw muscle tension may allow the jaw joints to achieve their most natural, relaxed orientation and allow the jaw to close in its best and most natural path of closure, **which may be different than what the patient originally presents with**. This only occurs in the presence of symptom relief. In this event, your dentist may recommend modifying the occlusal scheme of your teeth to achieve the most efficient closure (or bite).

One of the specific scenarios of the above description is the development of an anterior open bite (and is also described on the *Frequently Asked Questions* page), which can occur as a result of the seating of the condyles following normalization of the musculature. This can only happen if the condyles were in a position anterior and inferior to their optimal musculoskeletally stable position, and then seat to a more posterior-superior position. This requires the mandible to pivot/rotate at the most posterior molars (thus giving the appearance of posterior supra-eruption), allowing the condyles to seat more posteriorly and superiorly, while the anterior mandible rotates posterior-inferiorly, which, depending on the original degree of incisor overlap, may present as an anterior open bite.

This is a rare development, and clinically can be observed to varying degrees in approximately 5% of those patients using the NTI-tss for pain relief and prevention. Additionally, if this does develop, it does so following a relief of the patient's symptoms. There is no method in advance to predict how much, if any, condylar seating will occur.

The vast majority of these occurrences can be restored to provide incisal biting by performing occlusal reduction of the interfering posterior cusp tips while the patient is in a protrusive incisal bite relationship. However, in a small number of cases this will not be adequate to close the anterior incisal bite. If the patient desires to regain a functional incisor occluding relationship (many times patients are so satisfied with the symptomatic resolution that they elect to do nothing more), a more involved restorative treatment plan may be required, including fixed restorations, orthodontic or orthognathic treatment.

As with any procedure, where a variety of outcomes is possible, all reasonable outcome scenarios should be disclosed. For the patient, the NTI-tss may prove to be both a symptom treatment device and a diagnostic device, which demonstrates that the condyles were not in their optimal seated positions. However, the treating dentist may not desire to be involved in the treatment modalities necessary to provide an occlusal scheme to the patient's satisfaction, in which case the dentist may elect to not provide treatment with the NTI-tss at the onset.

## USE IN ARTHRITIC OR CONDYLAR DEGENERATIVE CONDITIONS

The NTI-tss device is intended to reduce the intensity of nocturnal muscular hyperactivity and the potential joint strain and condylar load that can accompany it.

During normal masticatory function (in a patient with an arthritic or degenerative joint), naturally occurring reflexes protect the joint(s) from any acute trauma that would cause progression of the condition. However, those reflexes are not present during nocturnal parafunctional activity, and the joints are at considerable risk.

Although the NTI-tss device is not contraindicated in such conditions, extreme care must be taken in its application. During parafunctional occluding events, the more translated and rotated the condyle is, the more exposed it is to pathologic strain and load. Therefore, the practitioner must confirm that the NTI-tss

device does not provide for excessive interocclusal freeway space during parafunctional occluding events (which would result in an additional degree of translation and rotation). Additionally, the practitioner must confirm that in extreme lateral excursions, an opposing canine tooth **cannot** touch the device. Canine contact allows for near maximal clenching intensity, and with the condyle excessively translated, this can present a worse scenario than not using the device at all.

## USE WITH VENEERS

A properly bonded veneer, cemented crown, or bonded restoration is not a contraindication to place an NTI-tss® device over those restorations. In fact, many times an NTI-tss is recommended for use in the protection of those restorations. An NTI-tss will not be able to pop off a well-bonded veneer, nor can it remove a properly cemented crown.

Veneers on the opposing incisors are at a slight degree of risk, depending on the thickness of the incisal porcelain, when contacting the Discluding Element of an NTI-tss device. The Discluding Element may chip off the thin porcelain that wraps over the incisal edges. If maxillary and mandibular veneers are being placed as part of the protocol to restore previous damage from bruxism in the absence of symptoms, opposing NTI-tss devices may be considered. This is done by using a Standard, Standard-Wide, Reduced Vertical, and Incisal Guidance Device on the maxillary teeth and a Universal Device on the mandibular teeth.

Prior to delivering an NTI-tss for the protection of esthetic restorations, interview the patient regarding any signs and/or symptoms of muscular parafunction (for example, if patients feel good, or not, upon waking). Twenty percent of all adults have some degree of symptomatic nocturnal muscular parafunction (some estimates are far greater). If patients report some degree of symptoms, they should be informed of the potential resolution of their symptoms and accompanying possible changes in condylar position, resulting in a change in occlusal scheme. For example, if an NTI-tss is planned following the delivery of porcelain veneers, deliver the NTI-tss a couple of weeks prior to preparations. In the event there is condylar repositioning (potentially opening the anterior bite), posterior equilibration and design of the veneers can re-establish the occlusal relationship.

## ANTERIOR CLASS III “EDGE-TO-EDGE” OCCLUSION

The protocol for the application of an NTI-tss device, whether it is made directly chairside using the commercially available NTI-tss blank, or indirectly in a lab, remains constant. In the case when incisal overlap is minimal, edge-to-edge, or open, the height of the Discluding Element must provide posterior disclusion in all excursive movements.

The commonly used Incisal Guidance Device (whose trough is slightly wider to allow for crooked incisors) has a Discluding Element with a lower-profile “hump” (instead of the traditional “bump”). In order to ensure posterior disclusion, it may need to be enhanced vertically by adding acrylic. For example, in the case of an anterior open bite, the Discluding Element may need to be built up 2 more millimeters.

If the mandible is wider than the maxilla, then the placement of a Maxillary Device has less chance of an opposing canine making contact with it in excursive movement.

## UNIVERSAL DEVICE USE

### Supporting periodontally involved teeth

Adapt the Universal matrix to the incisors that oppose an NTI-tss. The Universal will provide support and retention for the opposing incisors.

### Intense grinding and divoting of the Discluding Element

In the continued presence of intense grinding, a groove or divot may develop on the Discluding Element.

The practitioner may elect to adapt a Universal matrix to the opposing teeth (instead of periodically filling in the divot with orthodontic acrylic) in addition to the present matrix. Any device that has a Discluding Element should be reduced to accommodate the increase in vertical dimension that the addition of the Universal matrix creates. The two opposing matrices (Lexan polycarbonate versus Lexan polycarbonate) provide very little friction, and will eliminate the periodic divoting of the Discluding Element.

This is only indicated for severe grinding and not to be provided to the symptomatic clenching patient.

### Orthodontic bracket adaptation

Obviously, neither the Universal nor the Standard-Wide will fit over the brackets. Cut away the labial wall so that it extends to just under the brackets.

If using the Universal, adapt acrylic resin to create a Discluding Element (not necessary when using the Standard-Wide) and relin with the thermoplastic beads. Have the patient press the extruding palatal TPB material against the roof of the mouth, and use an instrument to keep the TPB material from flowing up into the brackets on the labial prior to its setting. The patient may need to use a plastic instrument to engage the apical edge of the matrix to disengage.

Each night, the entire device should be slightly softened in hot water and re-adapted to allow for the potential tooth movement that might have occurred during that day.

### Custom fabrication of an NTI-tss-type device for a Full Denture

1. Take an impression and pour a model of the maxillary full upper denture.
2. Using .06" thick plastic sheeting for vacuum forming, make a “suck-down” of the entire model (referred to here as a “stent”).
3. Using orthodontic acrylic in a damp, doughy stage, form a Discluding Element on the warm stent that will oppose the midline of the mandibular incisors.
4. When cutting away the stent from the model, follow the borders of the denture and do not remove the palate portion. The result will look like a clear, thin, full upper denture with a Discluding Element on it.
5. Snap the stent over the patient’s denture and instruct the patient to wear it during sleep (along with an opposing denture if applicable).

Typically, the patient’s appearance may improve *with the device in place*, suggesting that the vertical dimension of occlusion of the denture was inadequate. The intensity of their clenching was most likely *not* the cause of their symptoms (full denture wearers can’t generate the kind of intensity that someone with full dentition can), but was caused/triggered/enhanced by the over-closed rotation of their condyles *during* their clenching activity (it would not be unusual for a full-denture patient who clenches to complain of joint pain, whereas a *primary clencher* (who doesn’t clench excursively) with a full dentition rarely complains of joint pain).

## PEDODONTIC CUSTOM DEVICE

For application of an NTI-tss-type device with children, refer to the “Pedo custom device” section in the Chairside and Administrative Insight & Help link located on the home page of [www.nti-tss.com](http://www.nti-tss.com).

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—Dr. Steven Rose

## THE VANISHING LINE BETWEEN FUNCTION AND PARAFUNCTION

James P. Boyd, DDS

Barry Glassman, DMD

Within dentistry, the terms *function*, *dysfunction* and *parafunction* have slowly begun to lose their critical individual meaning, thereby potentially sacrificing the significance of their considerable and diagnostically relevant differences.

Oftentimes, a presentation of data regarding the patient's *dysfunction* (electronic measurements, varying types of imaging, and complex descriptions of signs and symptoms), collected while the patient is sitting in the practitioner's office, is mistakenly presented as the etiological diagnosis, when it is *parafunction* that is the perpetuating or causative source of the patient's condition. The resulting treatment plan then revolves around management, rather than prevention. Recognizing and acknowledging the differences between *function*, *dysfunction* and *parafunction* can make for a more accurate assessment of the etiology of a patient's condition. The resulting **diagnostically driven** treatment plan then addresses the causative or perpetuating source of the patient's condition, *parafunction*. Treatment can then become an active prevention, rather than ongoing management.<sup>1</sup>

## NORMAL MANDIBULAR FUNCTION

In order to fully appreciate *parafunction* (and then provide a treatment to prevent it), a clear understanding of the *normal, functional role* of the masticatory musculature is essential. Normal mandibular function is best understood by observing it in its dynamic components: rest position, opening, and closing.

### Rest

When not chewing, swallowing, or talking, the mandible resides at its “rest position.” This position occurs in the absence of voluntary trigeminally innervated elevator musculature activity.<sup>2</sup> Without active elevation, the opposing maxillary and mandibular teeth are not occluding. As the pulling force of gravity attempts to depress (open) the mandible, the stretching of the sympathetically innervated spindle fibers<sup>3</sup> (which reside within the elevator musculature, primarily the temporalis) elicits a reflexive tension to the intrafusal fibers of the spindles, providing a degree of elevation, thereby maintaining a constant “freeway space” (of approximately 2 mm) between the opposing molar teeth. As the involuntary sympathetic tone varies (due to a stressful physical or emotional situation, for example), so does the tension within the spindle fibers, thereby altering their length.<sup>4</sup> This results in dynamic alterations of the freeway space.<sup>5</sup> Sudden bursts of sympathetic activity recruit trigeminal activity, producing varying durations and intensities of teeth clenching.

### Functional depression (opening) and elevation (closing)

Starting from the rest position, *functional* mandibular depression (opening) results from the simultaneous contraction of two muscle groups that insert on opposite ends of the mandible: the *lateral pterygoids* and the *digastrics*. As the digastrics pull the chin “down and backward,” the lateral pterygoids (at the opposite end of the mandible) pull the condyles “forward,” with the overall effect being the rotational opening (depression) of the mandible.

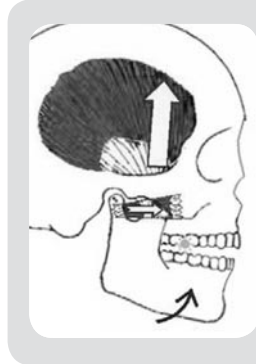
*Functional* elevation (closing) ensues as the temporalis, masseters, and medial pterygoids contract while the digastrics and inferior bellies of the lateral pterygoids relax. During *functional* mastication, the resistance of the bolus of food elicits a proportional intensity of contraction of the elevators during elevation. Depending on the purpose of the elevation, the lateral pterygoids may maintain a degree of tension, thereby influencing the mandible's path of closure and initial tooth contacts.

For example, if the purpose of closure is incising with the anterior teeth, the lateral pterygoids maintain a degree of tension during the elevation, depending on the required degree of protrusion. Incising food with the anterior teeth obligates the lateral pterygoid to remain actively tensed during the closing stroke, maintaining the condyle in an advanced and anteriorly braced posture against the eminence of the temporal bone.

The reduced efficiency of the resulting level arm, combined with reflexive suppression of elevator intensity by anterior tooth contacts, provides a governing limit of the intensity of the elevation during incising. If mastication with the molars is intended, then the lateral pterygoids will relax during the elevation.

### Adaptive capacity of the lateral pterygoid

Occasionally, there exists a premature contact during mastication (teeth typically don't physically occlude with each other during mastication, as the bolus of food is residing within the freeway space). In the event that this tooth contact *interferes* with the efficiency of the chewing strokes (a sudden and forceful tooth contact during mastication will instantly cease the elevation and trigger a reflexive opening), a lateral pterygoid will maintain a degree of *functional* tension **during the closing (elevation) of the mandible**. This natural and protective "programming" capacity of the lateral pterygoid serves to alter the condyle's position during mastication, thereby allowing the avoidance of the interference.<sup>6</sup>



As the mandible is being elevated during masticatory function, the elevators' orientation and tension naturally seat and brace the condyles in a superior/anterior direction, while the depressors (lateral pterygoids) are relaxed.

However, the presence of an interference (on the first molar in the diagram) will elicit tension of the lateral pterygoid(s) during closure. A normal functional adaptive capacity of the lateral pterygoid, it becomes programmed to alter the condyle's position during closure, thereby avoiding the interference during chewing. Vigorous and intense chewing may rapidly fatigue the lateral pterygoid, as the relatively weaker lateral pterygoid tenses against the powerful closing strokes of the temporals.

The functional elevation stroke of mastication (or swallowing) is complete upon the occluding (or near approximation) of the teeth, which normally remain "in occlusion" for only .2 seconds.<sup>7</sup> The occluding of the teeth triggers the functional reflexive contraction activity of the depressors (re-opening) and the relaxation of the elevators.

## PARAFUNCTION

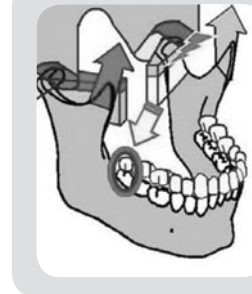
*Parafunction* of the masticatory system occurs following normal mandibular elevation, with the elevators *maintaining tension, continuing with the purposeless occluding of the teeth*. The intensity of the continued occluding elevation dictates the degree of resistance encountered by the reflexive discluding attempts of the lateral pterygoids. This muscular conflict allows for potentially destructive acts that vary in **frequency** (the number of times the act occurs), **duration** (how long each act lasts), **intensity** (the degree of contraction of the conflicting musculature), and the **position** of the mandible during the act. Of these four variables (frequency, duration, intensity and position), the intensity of the act is the most influential of the potential resulting signs and symptoms. Significant *parafunction* occurs almost exclusively during sleep, where intensity of elevation can exceed voluntary maximum,<sup>8</sup> thereby disguising its activity from the patient. While potentially able to adversely affect the patient's quality of life, the intensity and nature of the *parafunction* is reflected in the clinical *dysfunctional* presentation, making its diagnosis illusive to the practitioner.<sup>1</sup>

### Parafunctional excursive clenching

One example of a parafunctional act is excursive clenching. Following the occluding of the posterior teeth, the elevator muscular continues to maintain mandibular elevation, *but in an asymmetrical manner*, allowing one lateral pterygoid to advance its condyle with less resistance than the other.

Unlike protrusive clenching, where both condyles are braced and loaded in their naturally intended anterior/superior orientation, in excursive clenching, one condyle advances translates more than the other, as the opposite (contralateral) side's restrictive elevation is more stabilizing. As the ipsilateral

condyle translates, medial strain increases on the condyle, as it is pulled toward the pterygoid plate by its respective lateral pterygoid. Whereas the articular disc that resides between the condyle and the temporal eminence is *designed* to be "loaded" in an anterior/superior direction (as in normal anterior incising), the medial pull of the lateral pterygoid during excursive clenching can exert an excessive strain and pathologic load to the condyle and disc. Excursive (or unilateral) clenching can cause and/or perpetuate internal derangements and is commonly recognized as a "temporomandibular (joint) disorder."



In the adjacent example of parafunctional excursive clenching, the right temporalis is maintaining the occluding of the right second molars. While the right condyle is therefore "stabilized," the left lateral pterygoid has less resistance to its attempt at discluding the teeth on the left side. The net effect of the left lateral pterygoid's efforts is a medially directed strain on the condyle and load to the disk.

Whereas in normal *function* the lateral pterygoids can adapt to avoid the second molar interfering contact *during closure*, the occluded contact provides varying degrees of resistance to their *attempts at re-opening in parafunction*.

## THERAPEUTIC PLAN

Chief complaints including combinations of headache, migraine, face pain, jaw pain and/or restriction, neck pain and/or restriction, and sinus pain and/or pressure may present a seemingly complex and multifactorial diagnosis, when in reality they may all be a direct result of varying degrees and orientations of nocturnal masticatory parafunction. The cornerstone of successful patient care is a diagnostically driven therapeutic protocol. Oftentimes, the dysfunctional presenting signs and symptoms are mistaken for the etiologic source of the patient's complaints.<sup>1</sup>

The therapeutic goal then becomes directed at addressing the parafunction by altering one or more of its four components: intensity, duration, frequency, and position. Medications that alter sleep patterns (rarely will any of the medications used in pain management *not* alter sleep patterns) can significantly and unpredictably influence the duration and frequency of parafunctional activity (although unfortunately with the occasional undesired effect of increasing the activity).

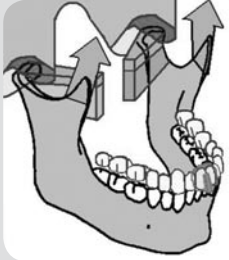
Traditional dental therapy has been directed at addressing the interferences within the scheme of the occluding teeth, and/or the position of the mandibular condyle during the parafunctional event, oftentimes with the assumption that these are the causative or perpetuating etiological factors of the parafunction.

Identification and removal of the occluding interferences that influence parafunctional activity can decrease the resistance to the lateral pterygoids' attempts at translating the condyle(s). The resulting reduction or elimination of the parafunctional strain and load to the TM joint may reduce or eliminate the associated dysfunctional signs and symptoms. If these clinical signs and symptoms had been the patient's chief complaint, the practitioner concludes that the occluding scheme had been *the etiologic source* of the parafunction, rather than irritating and influential resistance to parafunction.

The mandibular condyles' position is constantly changing, corresponding to the nature of the activity. For example, the clinical incisal height of the initial occluding teeth upon mandibular elevation dictates the anterior/posterior and inferior/superior condylar orientation, and creates the vertical dimension of occlusion (VDO). The mandible's natural vertical dimension of rest (VDR) occurs with the mandible slightly depressed from the VDO, providing for approximately 2 mm of freeway space. Therapeutically increasing the freeway space (the VDR) through TENSing (transcutaneous electrical nervous stimulation) of the spindle fibers within the elevating musculature, allows the dental practitioner to proportionately increase the corresponding VDO (by various means of providing removable or permanent dental prosthetics), while still allowing for a natural degree of freeway space. This mandibular

advancement or “anterior repositioning” of the VDO can be beneficial, for example, for those patients whose articular disc is permanently displaced anterior to the condyle in their presenting VDO and may also beneficially alter the nature of the parafunctional activity, thereby reducing or eliminating the associated dysfunctional signs and symptoms.

A therapy used to reduce the *intensity* of the elevation during the parafunctional act utilizes an anterior removable prosthetic during sleep, which replicates the effect of incisor-only contacts. Providing contacts exclusively to the incisors minimizes the intensity of the elevator musculature, while maintaining the condyles in their naturally braced positions against the temporal eminence.<sup>9</sup> The available resistance encountered by the lateral pterygoids during parafunction is significantly reduced, while the device is customized to create a minimal inter-occlusal distance, thereby minimizing the extent of condylar translation and resultant strain during excursive and protrusive parafunction. The suppression of the intensity of the parafunctional clenching and resultant minimization of joint strain and load reduces or eliminates the associated dysfunctional signs and symptoms, thereby allowing the practitioner to proceed with restorative dentistry. Although a pre-fabricated modified-anterior-midline-point-stop device that the practitioner retrofits and customizes has been approved for marketing by the US FDA for the prevention of medically diagnosed migraine pain and for the prevention of temporomandibular disorders,<sup>10</sup> a practitioner can easily fabricate such a device in his own lab.



A modified anterior-midline-point-stop device can easily be made on either arch (the adjacent example shows a maxillary device) by using a .06" thick vacuum-formed plastic sheet. The device encompasses the incisors (at least both centrals and mesial halves of the laterals) and is modified by adapting a “Discluding Element” using orthodontic resin. The DE is altered to provide disclusion with minimal freeway space in all centric, excursive and protrusive positions, and aligned to prevent strain to the incisors opposing the DE. The device is worn primarily during sleep and cannot be used during function, thereby preventing any adverse tooth movement or supra-eruptions.

## SUMMARY

Parafunction of the masticatory system occurs following closure and *during* intense occluding of the teeth (of which considerable significance occurs during sleep), while dysfunction is a clinical observation of the results of parafunction. Dysfunctional signs and symptoms are often misdiagnosed as the causative and/or perpetuating components of the patient’s presenting condition. The nocturnal suppression of the intensity of the parafunctional clenching and minimization of joint strain and load reduces or eliminates the associated dysfunctional signs and symptoms, thereby allowing the practitioner to proceed with restorative dentistry.

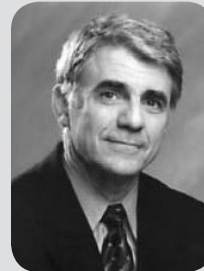
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## Condylar Seating to its Musculoskeletally Stable Position (CR) with Potential Development of an Anterior Open Bite

James P. Boyd, DDS

The mandibular condyle's static position within its fossa is a function of the scheme of the occluding teeth and the mandible-to-maxilla relationship during static clenching. If the intensity of the patient's parafunctional activity is not excessive (that is, symptoms are tolerable and wear is adaptive), neither the scheme of the occluding teeth nor the relationship of the jaw is an etiologic factor for a temporomandibular disorder. However, in the presence of intense, uncontrolled parafunction, certain occluding schemes and jaw relationships put the patient at greater risk of developing a more complex temporomandibular disorder.

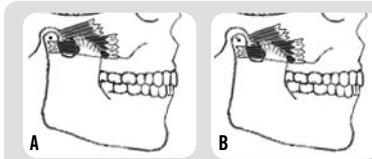
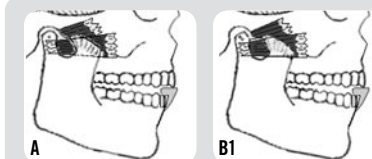
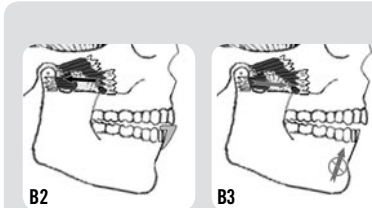


Diagram A demonstrates jaw clenching with the condyle in its optimal musculoskeletally stable position (black dot). Diagram B demonstrates jaw clenching with the center of the condyle (black dot) slightly inferior and anterior to its ideal position (gray dot). In the absence of intense parafunction, this is not a pathologic state. It occurs in a small minority of the population.

The chronically clenched state of the elevator muscles (a potentially pathologic state) shown in diagram B allows the lateral pterygoid to develop in a normal working length in this position. Because the pterygoid is not chronically tensed (as it is when avoiding occlusal interferences during jaw closure), it is not a candidate for "deprogramming."

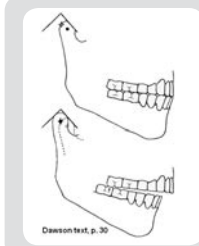


Providing the patient who has pathologic nocturnal clenching with an enhanced deprogrammer (diagram B1) will reduce the intensity of temporalis contraction by 75%, thereby minimizing condylar strain and disc load during parafunctional events. The deprogrammer provides only incisal contact in all excursive parafunctional events, while allowing minimal condylar translation and rotation.



Although it may take weeks (or months), elevating forces will slowly seat the condyle from its former position (diagram B1) to its optimal position (diagram B2), as the lateral pterygoid slightly stretches (in the direction of the black arrow) and remodels accordingly. Once the lateral pterygoid has remodeled and allowed the condyle to seat superiorly/posteriorly, its contraction can still only advance the condyle. There is no muscle to pull the chin up during protrusion (diagram B3), and if an anterior open bite has developed, the simple cessation of enhanced deprogrammer use may not allow the reestablishment of the less-than-optimal condylar position.

To the casual observer the posterior teeth may appear to have supra-erupted or the incisors may have intruded. However, no orthodontic studies show that posterior teeth supra-erupt due to lack of nocturnal alveolar stimulation. Nor have studies shown that mild to moderate sporadic incisal forces can cause an incisor to intrude.

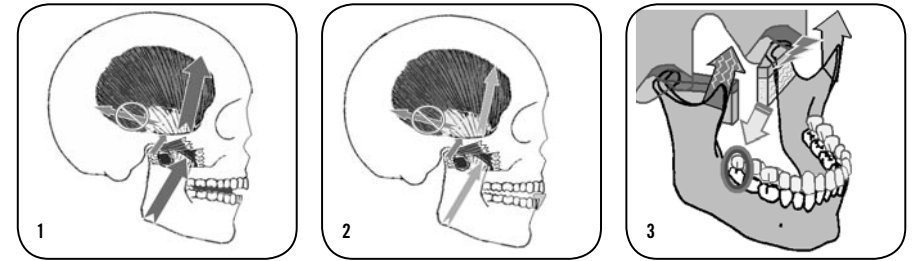


If the condyles do move to a more optimal musculoskeletally stable position (as shown in Dawson's text) the degree, if any, of the potential resulting anterior open bite is the degree of superior and posterior repositioning, and the initial degree of incisal overlap. For example, with a class III, edge-to-edge bite, the slightest condylar seating may prevent the incisor edges from occluding. Conversely, no changes may be apparent in occlusions with more than 50% incisal overlap, regardless of the degree of posterior and superior seating. Once the condyles are in their optimal position (and the patient's symptoms have resolved because the pathologic intensity of nocturnal parafunction has been continually prevented by nightly use of the enhanced deprogrammer), the occluding scheme may be adjusted or modified to the patient's satisfaction.

The paradox of the development of an anterior open bite (as described above) is that it occurs as the patient's symptoms resolve. Instead of being considered a diagnostic event that reveals a prior potential complication to pathologic activity, the anterior open bite is mistakenly identified as an adverse event. Before initiating treatment with an enhanced deprogrammer (especially in those with minimal incisal overlap), inform the patient of the potential diagnostic revelations that may occur as his or her symptoms resolve. The informed patient can then choose whether or not to proceed with treatment.

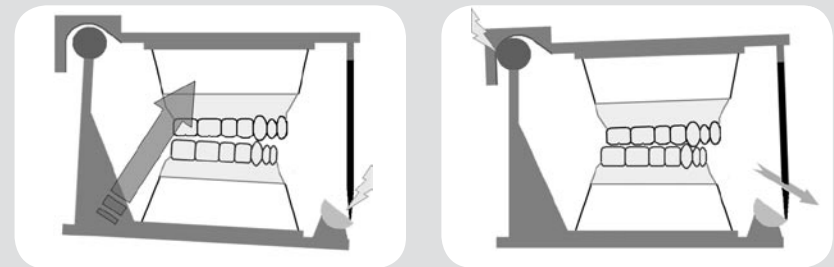
## The Physics of Condylar Compression\*

James P. Boyd, DDS



- 1) During the final arc of closure, the elevating musculature achieves its highest intensity of contraction. This is made possible by the resistance provided by bolus contact with the molars. The posterior temporalis is inactive, as its role of retruding the mandible after the translation of the condyles by the lateral pterygoids has been completed. With the condyle now fully seated, the superior head of the lateral pterygoid tenses and braces the disc against the superior and anterior directed load or the condyle, which is created by the force vectors of the elevating musculature.
- 2) The natural act of incising provides for the same direction of force vectors, but with far less intensity.
- 3) Actual pathologic condylar compression occurs not during functional closure (as in diagrams 1 and 2), but during the parafunctional act of *resisted attempts at reopening*. In diagram 3, the temporalis on the right side maintains tension following the occluding of the teeth. As the lateral pterygoid on the left side initiates the translation of its condyle (the act of reopening after the occluding of the teeth), it meets with resistance from the still-occluding teeth on the right side. The left lateral pterygoid pulls the condyle in the pathologic (medial) direction, generating considerable strain on the condyle and a shearing compression on the disc.

### How an articulator misrepresents reality



**A)** For an articulator to truly represent functional closure, the maxillary cast must be stable and the mandibular cast must swing freely. Grasp the base and elevate/rotate it in a superior and anterior direction. The extension of the incisal pin should replicate an incisal bite stop. The orientation of the incisal guide plate (not the condyle) is responsible for any strain on the pin (or incisor).

**B)** When the base of the traditional articulator is stable, elevate the maxillary cast and slowly lower it. With the incisal guide pin extended, gravity and your pull on the pin advance the maxillary cast (a completely unnatural act), giving the illusion of posterior joint space compaction.

\*May BM, Garabadian C. Reducing condylar compression in clenching patients. *Crit Rev Biomed Eng.* 2000;28(3-4):389-394.

The two major muscle groups used during clenching activity are the masseter and temporalis muscles. EMG readings of the masseter and temporalis muscles rise significantly during times of macro-clenching. Clenching occurs when the masseter and temporalis muscles contract, pulling the mandible superiorly. The continued contraction of the masseter and temporalis muscles results in compression forces on the teeth and temporomandibular joints. Theoretical joint loading models are utilized to demonstrate the load on the TMJ due to forces generated by the masseter and temporalis muscles. This study measures the EMG readings during bilateral macro-contraction of the masseter and anterior temporalis muscles. An appliance is fabricated to disengage the posterior teeth and a second series of EMG readings is taken to record lowered EMG readings. The vector forces of the reduced EMG recordings demonstrate reduced condylar compression during macro-clenching.



## Restorative Uses of the NTI-tss® Device

In addition to preventing migraine pain, the NTI-tss is effective for restorative procedures.

- **Diagnostic**—Is that tooth sore because it needs a root canal, or because it has been traumatized at night? Does the patient have a true TMD-related problem or simply muscle pain? The NTI-tss can help you know for sure
- **Protective**—Keep your worrisome patients comfortable during treatment as well as after. Make sure your restorative treatments are protected at night and keep temporary restorations from being dislodged
- **Investigative**—Finding the correct bite position is no easy task. Whether you call it CR, apex of force, or restorative centric, finding a repeatable, comfortable, and reliable position in which to restore is critical. Using the NTI-tss before treatment, within the bite registration procedure, during the temporary phase, and after treatment enables you to keep your patient happy and comfortable

## NTI Patient Profiles—Restorative Use Examples



### **Diagnostic function** John M., 65 years old

- Extensive crowns and bridges
- Numerous root canals, mostly following crown placement
- Presents with a key diagnostic sign that dentists often miss—most crowned teeth shouldn't require an endo procedure
- Do you think his issues might have something to do with clenching and grinding?



### **Protective function** Gary S., 60 years old

- Broken and worn front teeth that don't enhance his smile
- History of grinding and clenching his teeth
- Porcelain on his upper teeth is obviously going to be in danger
- Using the NTI-tss device at night may prevent breakage



### **Investigative function** Steve B., 45 years old

- Nice smile, but retractors reveal hidden issues
- Extensive tori and abfractions
- Leaking restorations from torque at the margins
- Exposed nerve from an abfraction (#22)



## **Conclusion**

To restore patients such as these, you need to have a great starting place (their restorative centric), where their jaw is relaxed, comfortable, and seats in a consistent and repeatable position.

Before, during, and after treatment, the NTI-tss makes the job easier, quicker, and more reliable.

You won't need anything else!

Cases supplied by Rick Coker, DDS, Tyler, Tex.



**THE LAB-FABRICATED VERSION OF THE NTI-tss®  
EXCLUSIVELY FROM KELLER LABORATORIES, INC.**

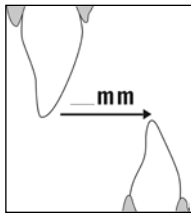
**When you:**

- Don't have the time for chairside fabrication.
- Need a custom laboratory solution.
- Want a long-term, durable, and crystal clear appliance.

**What to Send Keller:**

**1. Send full arch models or impressions.**

- To avoid receiving broken models, we prefer impressions made with a nonalginate material such as AlgiNot™ from Kerr or Position™ Penta™ Vinyl Polysiloxane from 3M.
- The additional accuracy of PVS improves retention.



**2. Send a Maximum Protrusive Measurement '+2'.**

- Have patient protrude as far as possible then use a ruler to measure distance in millimeters from the facial of 8 & 9 to the incisal facial of 24 & 25. Write the measurement on the Rx adding '+2' (6mm + 2).
- This written description helps us determine accurate DE length. This measurement gives us current range of motion. The '+2' provides additional length for increased range of motion after treatment begins.

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including

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**NTI-tss PLUS™ 5-POINT CHECKLIST FOR INSERTION**

When delivering an NTI-tss Plus you need to confirm that the appliance meets critical guidelines for patient safety, comfort, and compliance. The goal is no tooth contact on plastic or tooth structure from the canine back, regardless of patient functional or parafunctional movement.

**1. Retention and Comfort:** Ask the patient to remove the appliance using only their tongue, lips, cheeks, and facial muscles. If they cannot remove it and retention is secure, move on to the next check. If they can displace it and pop it out, you need to reline the appliance using a very small amount of SNAP acrylic, usually in the CEJ area. Also, at this time ask about sharp edges, overextensions, and other surface irregularities that need smoothing.

**2. Centered:** The discluding element (DE) of the appliance should be centered on the two opposing centrals. This helps distribute the clenching load on the two teeth in equal proportion. The DE centered on one opposing tooth will cause patient discomfort. Centered does not mean the DE is necessarily aligned with the maxillary or mandibular midline. Adjust, reduce, or widen the DE as necessary to center it and balance the centric stops before moving on.

**3. Protrusive Protection:** Ask the patient to maximally protrude and retrude the mandible. Check to be sure the patient does not get "in front" or "behind" the DE. Remember your goal is to disclude all the canine/posteriors in all movements. Extend or shorten the DE as indicated.

**4. Lateral Excursive Clearance:** After confirming there are no tooth contacts in protrusive, have your patient slide laterally left and right. Again, confirm there are no posterior tooth contacts during these movements. The amount of vertical clearance in these movements should be minimal. Reduce the DE height if possible to minimize vertical opening. If an increase in the DE vertical is necessary to avoid tooth contacts, either add to the DE height or reduce the interfering cusps.

**5. DE Angle Minimizes Translation:** The angle of the DE should not unnecessarily increase vertical opening in protrusive. A general guideline is that the angle of the ramp should be parallel to the maxillary occlusal plane.

Recommended add-on materials include SNAP acrylic (Parkell, Inc.) and Triad LC with bonding agent (DENTSPLY).

**How to Send Your Case**

1. Call 1-800-Go-FedEx and Press '0' when asked to select an option.
2. Ask to schedule a pick up, which is to be billed to the Keller account.
3. Request 2-day express service.
4. Supply details for pick up: weight (in pounds), address, business hours, etc.

**FOR TECHNICAL OR PROCEDURAL QUESTIONS, CONTACT**

**NTI-TSS, INC.**  
***PROFESSIONAL RELATIONS DEPARTMENT***

**MONDAY-FRIDAY 9:00 AM TO 5:00 PM (EST)**  
*(Voice Mail available after hours)*

**(877) 550-2992 – Toll Free**  
**Fax: (248) 666-3154 – 24/7**  
**Email: [help@nti-tss.com](mailto:help@nti-tss.com)**

**or**

**Contact James P. Boyd, DDS**  
(Developer of the clinical protocol)  
**Fax: (772) 365-7782**  
**Email: [Jim@DrJimBoyd.com](mailto:Jim@DrJimBoyd.com)**  
(Write NTI as the subject title in your email  
to avoid being filtered into a SPAM folder.)

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**Via the Web**  
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