

**Clinical Research Foundation
(A non-profit Foundation for Research
and Charitable Endeavors)**

**SPLINT THERAPY:
WHAT WORKS,
WHAT DOESN'T AND WHY?**

**Terry T. Tanaka, DDS
Clinical Professor,
Advanced Education in Prosthodontics
University of Southern California
School of Dentistry**

**Email: ttanaka@usc.edu
Web Site www.TerryTanakaDDS.Com**

May 1,2011

Splint Therapy: 2011
What works, what doesn't, and why?
Terry T. Tanaka, DDS
May 2011

The following questions will be addressed in this program:

- When and why are splints(orthotics) indicated?
- Why is there continuing controversy about the effectiveness of splints? (Historical relevance, a lack of scientific evidence, lack of understanding of muscle and joint disorders, and economically driven diagnoses and treatment plans.)
- How do muscle and joint disorders affect occlusal stability and Centric Relation?
- How frequently are malocclusions and face pain not related to occlusal discrepancies?
- How are splints used in everyday restorative procedures and in complete occlusal rehabilitation?

*** When and why are splints(orthotics) indicated?**

- Splints are effective in reducing musculoskeletal pain (myalgia, myofascial Pain, osteoarthritis and systemic arthritis (RA).
- Splints are valuable in stabilizing the occlusion in patients with anterior open bites and other malocclusions.
- Splints are helpful when restoring the occlusal vertical dimension of occlusion in patients with severely worn dentitions.
- Splints are helpful in determining the proper anterior guidance and anterior length in patients with severely worn dentitions.
- Splints, when properly made, provide a simple and reliable means of performing a complete rehabilitation, (segmental rehabilitation) of the patient.

Why is there continuing controversy about the effectiveness of splints?

- Historically, some clinicians and teachers, (*Stuart et al*), believed that splints intruded teeth without any scientific evidence or studies. *H Stallard*, a renowned orthodontist disagreed with the aforementioned clinicians repeatedly, stating that increasing the occlusal vertical dimension was a common practice in orthodontics. He also stated that unless a study similar to that of *Bjork et al* with implanted metal objects was done, their comments were without any scientific basis. A critical review of the scientific literature reveals that *There are no long term studies* of patients who have been randomly selected and with strict control groups that have even been attempted.
"Anecdote is not the plural of data."

Lack of understanding of muscle and joint disorders:

- Splints are an effective treatment for myalgia (muscle Pain), and myofacial pain and muscle co-contraction,(altering the sensory input, from PDL and pulp).
- Splints are also effective in providing equal and simultaneous contact of the opposing teeth. This equal distribution of the occlusal forces appears to provide a quieting effect on the muscles of mastication as demonstrated in EMG studies.
- Splints are most effective during the day *when the patient is awake* due to the ability of the Central Pattern Generator in the brain stem to sense maximum "tolerable occlusal forces." *Okeson 6th ed.*
- Splints and inter-occlusal devices have minimal effect in preventing the greater forces, (2x to 5x), during both REM and NREM sleep. *Gibbs, Lundeen, Mahan.*

* **How effective are splints in the treatment of myofascial pain of the jaw muscles?** *Dao TT, Lavigne, Feine, Lund, Pain 56 (1994) 85-94*

- 63 subjects were assigned to 1 of 3 groups
- Group A wore an *occlusal stabilizing splint* 30 min at each appointment
- Group B wore a *palatal splint* with no occlusal contact 24 hrs/day
- Group C wore an *occlusal stabilizing splint* 24 hours a day
- **Conclusions: “All groups had similar pain reduction ratings”**
What does this mean?
 - “Do palatal splints have a “placebo effect,” or is there another reason why they are effective?
 - Cr. V has both sensory & motor fibers. The sensory fibers provide sensory input that there is a foreign object, (the acrylic and or the arch wire) that the tongue can sense, proprioception, which results in the muscles avoiding contact with the opposing teeth, hence the muscle contraction and pain are reduced. Orthodontic separators are just as effective in relieving myofascial pain in patients about to start orthodontic treatment.
 - **Conclusion of the study: “If your primary objective is to relieve pain, almost any splint, (anterior or posterior) will be effective.” (anterior or posterior)**
 - **“Splints are effective for reasons other than having Centric Relation and Maximum Intercuspatation in the same position.”**
 - **“The type of occlusal scheme (CR, MI or Long Centric) is not the only factor that should be considered in the management of myofascial pain.”**

Clinical significance of TMJ sounds: (“Some science please?”)

- It is interesting to see how readily some dentists and “TMJ specialists” accept misleading advertisements and purchase “gimics” by manufacturers selling questionable “scientific instruments” to “diagnose” TMJ dysfunction. Examples are electronic instruments that are used to diagnose TMJ dysfunction that requires treatment. It is true that some instruments are able to reproduce joint sounds such as “clicking” better than a stethoscope. However, the well read clinician will understand that “a clicking TMJ,” does not mean the patient is having pain or dysfunction from that joint, it only confirms that there is a clicking sound from the joint structures. In fact “a clicking TMJ” is one of the least reliable signs for diagnosing a “sick TMJ. However, some individuals use these “electronic instruments” to “convince” the patient that the “clicking” is a sign of a sick joint and that the TMJ needs treatment.
Most of these instruments lack “specificity.” “While they may be able to help diagnose sick TMJs as being sick, they are also being used to diagnose healthy TMJs as being sick.”
- Why? 1) When “entrepreneurship” and an effective “sales pitch” is more effective than a “peer-reviewed study in a reputable journal,” it means that the doctor is not discerning enough to read good science-based information and make a proper diagnosis.

How do muscle and joint disorders affect occlusal stability and Centric Relation?

- It is commonly understood by anatomists that all joints, including the temporomandibular joints, undergo remodeling throughout life with thinning of the disc and remodeling, (flattening) of the head of the condyle and articular eminence. As the disc space diminishes, the elevator muscles continue to seat the condyle in the fossa resulting in greater wear of the posterior molars.
In patients with oral habits of clenching and bruxing, a progression of excessive occlusal wear, excessive interproximal wear, crowding of the mandibular teeth will be seen. With interproximal wear, the arch shortens and a malocclusion may result and even an anterior open-bite relation.

- Sustained muscle contraction in clenching and bruxing can lead to muscle co-contraction and a shortened resting muscle length. If this occurs on one side more than the other, the mandible may be deflected more to one side or anteriorly than the other resulting in a temporary malocclusion.
- In these patients, a splint is recommended initially, instead of an equilibration of the teeth. A stabilizing splint will provide equal and simultaneous contact of the maxillary and mandibular teeth on closure of the mouth which should reduce the muscle firing (EMG activity), resulting in a return to a normal resting length of the involved muscles. The occlusion will usually not require any alteration at this time.
**The key rule is, “do not adjust the occlusal of the teeth in any patient with muscle pain or muscle or TMJ dysfunction.” “Resolve the muscle and joint pain first with a splint or other reversible procedure or modality, e.g. stress management, and then reevaluate the occlusion.”*

Why are splints effective in reducing muscle pain and TMJ dysfunction?

The Nociceptive Reflex: see illustration in Okeson text 6th ed. p.37

- Full coverage stabilizing splints are still the standard appliance used by most dentists in the USA.

- **Anterior deprogrammers and deprogrammer type appliances** have gained popularity in the past several years but patients suffer from the same or worse TMJ problems that they started with, if the patient continues to clench on the anterior contacting surface. The same posterior occlusal nocturnal forces are now applied to the TMJs and not the posterior teeth because the muscles continue to close forcefully while there is no posterior contact on the splint to protect the TMJs.

-*Magnusson's study provided an interesting comparison between a stabilizing appliance and a popular anterior deprogrammer type appliance. (see chapter on "Splint Therapy" in Tanaka Manual for graduate students)

“If you are using an anterior jig, deprogrammer type splint, remember, the peripheral system, (Central Pattern generator) is relatively inactive during sleep and is unable to prevent the patient from biting with great force.”

Day time bite force = 162-185 lbs during the day- Nishigawa; Gibbs, Lundeen, Mahan

During sleep = 2.5x-5x greater forces during sleep - Nishigawa,; Gibbs, Lundeen, Mahan

Gibbs, Lundeen, Mahan, JPD 1981,1984,1986

Anterior Deprogrammer type splints

“Do not use them if the patient continues to clench and or grind on the anterior deprogrammer type appliance and scratches are seen on the appliances.” “This will cause injury to the TMJs.” “If a patient continues to clench on an anterior bite plane, the biting forces will be directed onto the disc causing injury.”

Anterior deprogrammer splints:

“The contacting surface should also be flat.

An angled contact will tend to drive the condyle posteriorly as the patient clenches, causing pain from the TMJ structures.”

•When are splints indicated?

- Day use- splints act as a biofeedback device or as a reminder to not touch the teeth together.

Biofeedback is effective only when the individual is awake.

- Night use - splints act to protect the teeth and crowns from wear and fracture when worn during sleep.

•Parafunction is generally considered a local factor

•Bruxing is considered a CNS disorder in 2011.

- Initially the splints used at night may appear effective, however 10-15% of these patients may start to clench and brux again on the splint.”

Prefabricated Anterior Deprogrammers

- 1. Purchase from Pankey Institute bookstore (25 per bag of deprogrammers)
- 2. Great Lakes Dental products (smaller size, but just as good)
- 3. Line the deprogrammers with “Futar” bite registration material or other clear material.

Questions to consider:

- What types are indicated? 1) Stabilizing splint, 2) Repositioning splint
- When should they be used? (Night or day or both?)

Type A and B Stabilizing Splints (ABCs of Splint Therapy, DVD)

- Type A - Stabilizing Splints - Minimal thickness; wear part or full-time
- Type B - Stabilizing Splints are made slightly thicker for decreased OVD; wear full time
- Type C - repositioning splints for acute disc displacement, (3-6 weeks only)

Type C - Anterior Repositioning Splints

- Anterior repositioning splints (type C) are used for acute disc displacement only. Use for only 3 weeks, and then adjust the splint back to the initial occlusal position (ICP)
- “If the disc has been displaced for 6-9 months, there is a 1% chance of repositioning the disc to its normal position with a splint.”
- “If you move the condyle forward and under the disc, this does not mean that you have “recaptured the disc.”
- “Do not orthodontically move the teeth to the anteriorized position.” *Okeson, Tanaka*

Splint Therapy DVD: “ABC’s of Splint Therapy.” Tanaka

Chapters on

- 1. Splint fabrication in the dental office by the assistant or dentist**
- 2. Splint Insertion and adjustment**
- 3. How can splints be used to facilitate esthetic procedures and to protect tooth colored restorations?**

:

Literature references and where to obtain materials mentioned in the program:

- Splint Therapy - *TT Dao et al, J Pain 1994; Dylina, T JPD*
- Splint Therapy - *Tanaka TT, “ABCs of Splint Therapy” DVD*
- Bruxing and nocturnal bruxing – *Giles Lavigne; Okeson 6th ed.*
- Bite forces – *Gibbs, Lundeen, Mahan JPD 1986,1988; Nishigawa; Sposetti; Kasahara*
- The Nociceptive Reflex – *Okeson J. 6th ed; Tanaka 6th ed.*
- Reflex Inhibition – *Travell and Simons*
- Is the pain originating from the muscles or TM Joints? *Okeson 6th ed; Tanaka DVD*
- Indications and contra-indication for splints (orthotics) – *Okeson 6th ed; Tanaka DVD*
- Stabilizing splints – *Okeson 6^o ed; Tanaka DVD and 6th ed.*
- Anterior bite plane splints and anterior deprogrammers – *Okeson 6th ed; Tanaka DVD*
- Anterior repositioning splints – *Tanaka DVD*

Materials:

- Prefabricated anterior Deprogrammers can be purchased from the Pankey book store, and the "Great Lakes" Company that sells splint Biocryl and the splint pressure pot.
 - -Kois Facebow for transverse occlusal plane problems – *Panadent.Com*
 - Artus Co.- Shim-stock 0.001" to check the occlusion on the splints and for crowns.
 - G.C. Pattern Resin – used as a centric record and posterior vertical stop.
 - Brasseler Co - large high speed bullet shaped diamond burs for adjusting the inside of the splint and the occlusal of the splint.
-

**** The material above is an abbreviated summary for Dr. Tanaka's full day lecture. More complete information is available in the DVDs and the Tanaka text(manual 6th ed.) in the *Tanaka Educational Library* on his website at www.TerryTanakaDDS.Com.**

**** The educational DVDs of Restorative and Occlusion Guidelines, Treatment Planning and TMJ Dissections that are used in over 80 dental schools and surgery programs are available on this website.**

**** NEW DVDs: in 2011**

(1) "Problem Solving Guidelines for Restorative Dentists" DVD series will be available in June, 2011

(2) "Implant Surgery: Advances and Complications" will be available in October 2011

****TANAKA, TEXT(MANUAL 7TH Ed):**

The 7th edition of the Tanaka Text is a working manual designed for graduate students in Graduate Prosthodontics, Endodontics, Periodontics and General Dentists. It is currently undergoing revision and will be available in September, 2011.

****A NEW schedule of interactive eCourses with Dr. Tanaka are being planned at this time. Watch the website, at www.TerryTanakaDDS.com**

"Best wishes for a happy and healthy 2011."

**Terry Tanaka, DDS
Clinical Professor,
Advanced Education in Prosthodontics,
University of Southern California, School of Dentistry
email ttanaka@usc.edu
www.TerryTanakaDDS.com**