

New Advances in our understanding of Occlusion: Biomechanical Principles of Occlusion

**Dwight Jennings, DDS
Alameda, California**

Dentistry has long recognized the importance of occlusion in dental treatment as it impacts patient comfort, durability of teeth and restorations, and the stability to bite. One's concept of occlusion is vitally important, as it is the over riding structure that guides treatment, whether it is for orthodontics, TMJ treatment, or crown and bridge.

Bernard Jankelson placed occlusion on an objective (scientific) basis with the development of neuromuscular concepts and instrumentation in the 1970's. These concepts were a great advancement over Angle's classification since they 1) measured muscles, 2) utilized TENS to generate a bite without torque and 3) incorporated the importance of muscles, not just teeth, when assessing proper occlusion.

As neuromuscular bite registration techniques utilize *resting* muscles to determine 3-dimensional jaw position, errors can occur in determining jaw alignment occasionally for various reasons. As a cross check, the position of the mandible during speech has proved helpful. More recently, clinical experience has proved "fair arc of opening/closing" to likewise be extremely helpful.

As occlusal concepts have been advanced primarily by prosthetic oriented dentists, current neuromuscular occlusal theory has not incorporated orthodontic/orthopedic wisdom. European dental orthopedic experience has shown that through appropriate therapy, mandibular rest position can be advanced. As a practitioner of European mandibular advancement concepts for over 25 years, I long tried to understand the principles involved and tried to reconcile them with neuromuscular principles. One of the questions that haunted me for many years was "is there a limit to how far the mandible can be advanced?" With the use of TENS, and the assistance of cross-checking with speech, I finally arrived at an answer. Clarity came slowly over the years, with sporadic insights from the many cases that I treated. I have distilled my understanding into what I call the Biomechanical Principles of Occlusion.

Biomechanical Principles of Occlusion

Hypothesis: Biomechanical principles of all joints must also be satisfied for the TMJ.

- a. Hypermobility of joints has negative sequella; joints do best when their range of motion is minimized
- b. excess range of motion increases stress on the musculature, joint tissues, and the supporting nervous system

That is:

- c. the temporomandibular joint functions best when occlusion is such that it supports jaw functions within a minimal range of motion (i.e. speech, rest, and open/close arcs are superimposed)
- d. Even though the TMJ has the ability to translate, the TMJ functions best when function requires it to translate least

Satisfying these conditions infers the following corollaries:

- a. speech and centric occlusion should be on the same trajectory
- b. there should exist a fair arc in open/close without anterior/posterior shifting of the mandible
- c. end on end bite (class III) creates an ideal functional jaw relationship in most cases (i.e. no translation for incising)

Validation of this hypothesis has come through many years of applying it to thousands of TMJ and orthodontic cases. End on end bite is supported by the fact that all recovered primitive human skulls have an end on end bite. Dr. Percy Begg, the famous orthodontist from Australia, came to the same conclusion about occlusion (i.e. that end on end bite was the most physiologic).

Creating and maintaining an occlusion that satisfies these underlying orthopedic principles has necessitated the development of unique treatment protocols that vary from those advocated by traditional orthodontic and TMJ treatment techniques. The first premise that I had to abandon was the neuromuscular occlusion notion that TENS is an effective means to determine the initial cranio-mandibular relationship. European orthopedic concepts have clearly shown that mandibular rest position can be changed with appropriate appliances. The question then arises as to where that position should be created. Clinical experience gained from treating thousands of brittle TMJ cases, has conclusively shown that all my patients do best when their mandible is positioned on the "fair arc of open/close/speech". Hence, it is with that goal in mind that I start treatment with orthopedic appliances. These appliances are fabricated in such a way that they proprioceptively guide the patient to an anteriorized position, a position which they quickly accommodate to. The position is often on the "fair arc of open/close/speech", which is often anterior to that generated by TENS. I find that anatomical splints are not adequate in many instances to proprioceptively guide the mandible to the appropriate interiorized trajectory. Un these cases I frequently use twin block crozats (picture). Subsequently, I use TENS to further refine the bite once habituation to the appropriate trajectory is achieved.



This process I described I find necessary if I am to get effective resolution of the many associated medical complaints found with TMD. Many of my patients, from long term trigeminal hypertonicity, have developed a generalized hypersensitivity syndrome that only starts to subside when they are precisely maintained on this trajectory. This phenomenon I believe is related to the trigeminal mesencephalic influence on neuropeptides.

A fair arc of closure is often not generated with TENS as multiple neuromuscular practitioners have noted (scan 1 imperfections). This appears due to a number of factors effecting resting mandibular position, including contracture, proprioceptive influences, joint compression, and body posture.

Original version published in the September 2007 Journal of American Academy of Gnathological Orthopedics

Inquiries: Dwight Jennings, DDS
2187 Harbor Bay Parkway
Alameda, Calif. 94502
510.522.6828
dejdds@aol.com

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