

The Politics and Science of Neuromuscular Dentistry 1965–1999

Robert Jankelson

One Man Versus the Establishment—1965–1987

Introduction

When asked by the editor of the Anthology to contribute a chapter on the past, present and future of neuromuscular dentistry, I willingly agreed. After several months of research and 100 pages of manuscript, I conceded that a chapter was impossible to adequately capture both the science and politics which inextricably intertwine the history of neuromuscular dentistry. The science of neuromuscular dentistry is well chronicled in hundreds of scientific articles and textbooks, including past Anthologies.

I have chosen to explore two eras that define the politics that have impacted the science and progress of neuromuscular dentistry. The early years, from 1967 to 1977, gave insights and appreciation for the intellect and courage of one man, Bernard Jankelson (“Dr. J”), as he single handedly challenged the

dental occlusionist establishment and their cherished dogmas. At any time during these ten years, if he had wavered in character or conviction, the science and technology we take for granted today would not be available. Dr. J's fight to bring a new technology and a new paradigm to treatment of the dental occlusion unleashed an epic confrontation with all the intrigues described by Becker. *"At this point the gloves come off. Already a lightning rod for the wrath of the Olympian peers, the would be Prometheus writhes under attacks on his or her honesty, scientific competence and personal habits. The pigeons of Zeus cover the new ideas with their droppings and conduct rigged experiments to disprove them. In extreme cases, government agencies staffed and advised by the establishment begin legal harassment."*¹

The second political era explores the politics following Dr. J's death in 1987 and encompasses epic battles in the American Dental Association and U.S. Food and Drug Administration. By 1986 the scientific foundation for *neuromuscular* concepts and techniques was firmly rooted in the scientific literature. The technology was recognized as safe and effective for the purposes intended by the American Dental Association Council on Scientific Affairs. The clinical techniques were precise, predictable and successful. Yet, the neuromuscular clinicians, their philosophy and their instrumentation continued to be attacked by gnathological gurus whose status and livelihood depended upon the defense of the scientifically indefensible, by third party carriers intent on denial of payment, by IME's whose livelihood depended upon denial of patient claims, and by psycho-social academicians whose research funding depended upon adherence to a particular TMD paradigm.

The story of neuromuscular dentistry is not unique in the history of science and medicine. The iconoclast is labeled a pariah. His ideas, hypotheses and technologies are cast to the outer fringes of the scientific credibility. Only the preponderance of evidence and the iconoclast's conviction support him as his family, character and state of mind are impugned by the establishment priesthood. Thus is the story of Dr. J, neuromuscular concepts and neuromuscular technology.

The Neuromuscular Paradigm

Kuhn, in *The Structure of Scientific Revolutions*, stated: *"Led by a new paradigm, scientists adopt new instruments and look in new places. Even more important, during revolutions scientists see new and different things when looking with familiar instruments in places they have looked before."*

Many great scientific discoveries began with self doubt. As late as 1960 Bernard Jankelson wrote: *"The dentist should do everything possible to see that centric relation and centric occlusion do coincide, since insta-*

*bility can trigger hypertonic contraction of muscles ..."*² Few disciples of neuromuscular dentistry would attribute this statement to the father of neuromuscular dentistry, Dr. Bernard Jankelson. How persistent the attachment to dogma when we do not have the ability to see the truth hidden in space or submolecular spaces. Almost every scientific breakthrough has been preceded by a technologic breakthrough that allows us to see the previously unseen. Galileo's telescope opened the universe to new observation and cosmic theories. The light microscope, followed by the electron microscope, revealed previously hidden secrets of the cell, leading to previously unimaginable medical breakthroughs. Angle recognized the importance of muscle forces on occlusal form and function as early as 1906.³ However, an occlusal paradigm that integrated the neuromusculature into a diagnostic and therapeutic protocol awaited the technological breakthrough that could predictably restore muscle to a more physiologic state prior to occlusal diagnosis.

The genesis of neuromuscular dentistry began with the collaboration of Bernard Jankelson and Dr. H.H. Dixon, a renowned muscle physiologist, working together at the University of Oregon School of Medicine in the early 1960s. In 1967 Dixon concluded, *"Experimental work with the myograph and chemical analysis indicates that fatigued muscle restores its energy with light, free motion at a rate below 60 contractions per minute. Fatigue spasm can be reduced by electrical stimulation. The device used should deliver a fraction of a milliamperere, at around 100 volts, in a biphasic wave, at a rate of 40 to 60 impulses per minute."*⁴

The technology to change muscle metabolism and resting states was the breakthrough that broke the clinical dependency upon an elusive and unproven CO/CR occlusal reference. The electrical parameters established by Dixon, the serendipity of anatomic proximity of the V and VII cranial nerves to the coronoid notch and a clinical paradigm of muscle relaxation as a precursor to occlusal diagnosis and treatment culminated in Dr. J's development of the first prototype Myo-monitor in 1967.

*"Transcutaneous electrical neural stimulation has the essential ability not only to relax the musculature, but also to initiate controlled isotonic muscle contraction to propel the mandible from rest position on an isotonic trajectory through the interocclusal space to a neuromuscularly oriented occlusal position in space."*⁵ The Myo-monitor provided a clinical tool to facilitate masticatory muscle relaxation and to generate an isotonic path of closure that was central to the neuromuscular paradigm. As so often occurs in science, the technology, i.e., the Myo-monitor, was necessary to define the new neuromuscular paradigm.

"In the past, character flaws couldn't wholly prevent the recognition of scientific truths. Both sides of a

controversy would fight with equal vehemence, and the one with better evidence would usually win sooner or later. In the past four decades, however, changes in the structure of scientific institutions have produced a situation so heavily weighted in favor of the establishment that it impedes progress in health care and prevents truly new ideas from getting a fair hearing in almost all circumstances. The present system in effect is a dogmatic religion with a self-perpetuating priesthood dedicated only to preserving the current orthodoxies."¹¹

The resistance to Jankelson's neuromuscular theory and the Myo-monitor was swift and predictable. Many a genius has been destroyed by people of lesser talent defending the status quo. It was inevitable that the genius and elegance of Bernard Jankelson's model for neuromuscular occlusion be challenged by a threatened establishment.

The Gnathologic Paradigm

Since 1986 TMD has been the arena for those opposing neuromuscular concepts and instrumentation. However, the early "Myo-monitor wars" were fought on the occlusal battlefield. Resistance to Barney Jankelson's neuromuscular theory came from the entrenched gnathologic school of occlusion. Gnathology had its origins in the mechanical concepts of Bonwill dating from 1850.⁶ This theory postulated that during function, teeth slid against each other in a characteristic mechanical pattern. Centric relation was originally defined as "the mandibular position when the heads of the condyles are in their most retracted positions from which the jaw can make free lateral movements."⁷ Lacking more physiologic parameters, gnathology also mandated that it is necessary to use a border reference position of the jaw as described by Posselt.⁸

Reproducibility became the operative mantra for seeking a "terminal hinge" position, however unphysiologic that position may be. Even reproducibility was an illusion.^{9,10} Lacking objective physical data the gnathologic literature degenerated into semantic obfuscation as each new definition of centric relation failed to meet scientific and clinical scrutiny. In 1959, Shore listed twenty-six different definitions of centric relation.¹¹ After 130 years of gnathologic tradition, Dawson was describing occlusal bite registration in terms more appropriate to a Victorian novel than to scientific discourse: "Now with gentle manipulation, the open jaw is lightly 'romanced' into the terminal hinge position."¹² Twenty-five years later the "romancing" continues, but hard, objective evidence that CR results in the desired therapeutic effect is notably lacking. With seven different definitions of centric relation in the Prosthetic Glossary, only the definitions change to accommodate the anachronisms of a nineteenth century mechanical theory of occlusion.¹³

The apparent inadequacy of the operator explained every clinical failure. The gnathologic gurus admonished and promised more predictable results if only the clinician could be more precise, "If the operator (or researcher) does not capture the true terminal hinge relationship, the value of a correct relationship cannot be fully appreciated. Furthermore, most experienced operators have confidence that their centric relation recordings are correct, but the study showed that experience cannot compensate for inadequate methods of manipulation or recording. Most of the methods used to manipulate the mandible into its terminal hinge axis do not work." The author continues, "It is also clear that recording it correctly is a demanding skill that must be carefully learned and precisely executed."¹⁴ Sadly, 25 years later the proponents of gnathology perpetrate the same unscientific premises. Even the most unapologetic of gnathologists concede the elusiveness of CR, yet rationalize the continuing semantic obfuscation. "Unfortunately, the definition of centric relation keeps changing in the literature. However the changes simply relate to improvements in jaw manipulation techniques and new knowledge regarding the anatomic and physiologic position of the condyle."¹⁵ This is equivalent to an astronomer redefining the definition of light years with the discovery of each new star.

One Man Versus the Establishment

While electrostimulation was a familiar modality in the everyday practice of physical medicine, neurology and cardiology, such modalities were deemed inappropriate by a dental establishment searching for the perfect articulator. Early practitioners utilizing the Myo-monitor were frequently derided as "jaw jerkers" or "jaw shockers." Those of us pioneering the early use of the Myo-monitor were amazed at the dramatic patient response to the *myocentric occlusal treatment position*. A common patient response to the myocentric occlusion was "that's where I told all those other dentists my bite should be!" Prosthetic occlusal adjustments suddenly were reduced by 80%. No more post-insertion syndrome. Anecdotal, but the clinical evidence that the Myo-monitor was a clinical breakthrough in treatment of occlusal and TMD problems quickly mounted.¹⁶⁻²¹

When cherished dogma are threatened by new ideas, evidence and technology, "The pigeons of Zeus cover the new ideas with their droppings and conduct rigged experiments to disprove them. Manuscripts submitted to scientific journals are reviewed for validity in the same way as grant requests. And who is better qualified to judge an article than those same eminent experts with their laurels to guard. Publication is accepted as evidence that an experiment has some basic value."²¹

The Myo-monitor war of 1970–1975 found the occlusal establishment, with all the resources of their refereed journals, aligned against a singular foe, Barney Jankelson and “his” Myo-monitor.

I remember well these years when my father, a meticulous researcher and writer, had paper after paper rejected by the reviewers, only to discover an anti-Myomonitor article of questionable scientific merit in these same journals. The conclusions were always the same, the Myo-monitor centric position is always anterior to centric relation²²⁻²⁴ and the Myo-monitor only stimulates muscle directly, not via neural mediation as suggested by Jankelson.²⁵⁻²⁶ Any assault on the sanctity of centric relation upon which reputations were built was to be stopped at the castle wall. The refereed journal was the platform to repulse the invasion of original thinking. The pigeons of Zeus were circling the challenger to centric relation.

Methodology in these studies often included the use of clutches, gothic arch devices and wax bite registration materials, and protocols assured to produce the researcher’s desired outcome. The finding that the Myo-monitor position was always anterior to centric relation was enough to condemn the Myo-monitor to the outer perimeters of scientific credibility. Practitioners using this device were assigned “fringe” status by the establishment. Accepting centric relation (take your choice of 26 definitions) as the occlusal gold standard was, and still is, an intellectual arrogance unsupported by scientific evidence. Yet, the CR icon stood unquestioned and off base to critical scrutiny by these men of science.

The establishment literature quickly “proved” that the observed muscle contraction was only direct muscle stimulation, not contraction neurally mediated via the V and VII motor nerves.^{25,26} If this were proven it would invalidate Jankelson’s theory of a Myo-monitor mediated *isotonic* closure to a *myocentric* position.

Meanwhile several studies, most conducted at Japanese Universities, supporting Jankelson’s premise of neural mediation were published.^{16,17,19} Jankelson’s intensity duration curve studies supporting the Japanese studies, after several years of delay at the referee level, were finally published in 1975.¹⁸ Later, Jankelson’s neural mediation theory was definitively confirmed by Williamson. Patients were given succinylcholine as a muscle paralyzer at time of intubation for orthognathic surgery. Succinylcholine antagonizes acetylcholine at the myo-neural end plate preventing neurally mediated muscle contraction. The only way a muscle can contract under such conditions is by direct depolarization of the muscle itself. There was no muscle contraction with the Myo-monitor stimulus. This was definitive evidence that Myo-monitor induced muscle stimulation is neurally transmitted.²⁷

By 1986 the weight of evidence began to quiet all but the most strident anti-Myomonitor foes. The period from 1977 to 1987 was marked by rapid improvement in the neuromuscular instrumentation. Neuromuscular instrumentation and techniques were routinely used in dental practices around the world.

Dr. J endured personal and professional vilification during the early years of the Myo-monitor and introduction of the neuromuscular philosophy. Strength of character and scientific validity were his only defense. After development and introduction of the J-2 Myo-monitor in 1969, he now tackled the challenge of developing objective measurement instrumentation to document masticatory function.

Dr. J’s Dream—Objective Measurement of Occlusal Function

In 1973 Lerman observed that “*It cannot be overemphasized that since symptoms are muscle based, occlusal therapy of the MSD should be muscle oriented. Unfortunately, present clinical techniques which establish either terminal hinge or centric placement do not consistently accomplish this. With current techniques, an entire physiologic dimension is largely missing from analysis of the occlusion, namely the occlusion’s compatibility with the muscles.*”²⁸

Funding the project himself, Dr. J assembled a R & D group of former Boeing engineers and biomedical engineers in 1970 to develop biomedical instrumentation to track jaw movement in three dimensions. Four years later, in 1974, the first K5 Mandibular Kinesigraph was introduced. The system sensed the spatial location of a small magnet attached to the labial of the lower incisor teeth allowing the clinician to diagnose and treat occlusal dysfunction with objective physiologic data.

Technology to monitor masticatory muscle activity at rest and in function in a clinical environment was necessary to elevate diagnosis and treatment of occlusion from art to science. Surface electromyography (EMG) is the technique by which the action potentials from muscle fibers are recorded and displayed. Surface EMG had been used in research institutions for many years to study masticatory muscle function. However, the first EMG designed specifically to monitor masticatory muscle in the dental office was introduced by Myotronics Inc. (EM-1*) in 1979. Real time EMG was integrated into the three dimensional computerized jaw tracking system in 1987, allowing the clinician to objectively correlate muscle activity and jaw position.

At the time of Dr. J’s death in 1987 most of his dreams had been fulfilled. A new occlusal paradigm was gaining wide acceptance. The Myo-monitor was being used successfully by thousands of dentists around the world. He had pioneered and developed the first three dimensional jaw tracking system. He

had collaborated with colleagues in Japan to develop the first clinical EMG to specifically monitor masticatory muscle activity. His contribution to the science of dentistry was a product of his professional passion and conviction. Shortly after Dr. J's death his disciples would need the same courage and conviction.

II. Posthumous Politics

ADA Politics 1988–1994

In 1986 the American Dental Association Council on Scientific Affairs granted the *Seal of Recognition* to Myotronic's neuromuscular instrumentation. The pigeons of Zeus could not abide the messengers of objective data. It threatened old dogma, it made IME rejections difficult, and as Becker described *"In general, projects that propose a search for evidence in support of new ideas aren't funded. Most review committees approve nothing that would challenge the findings their members made when they were struggling young researchers who created the current theories, whereas projects that pander to these elder egos receive lavish support."*¹

It was now time to slay the messenger. The political battlefield shifted from occlusion to TMD. In 1988 a small group identified with the gnathologic occlusal paradigm joined a small group from the American Association of Orofacial Pain (AAOP), then the American Association of Craniomandibular Disorders (AACD), to exert political pressures upon the ADA to rescind the Scientific Council Seal of Recognition for neuromuscular measurement devices. Dr. Norman Mohl was retained by the ADA to review the scientific safety and efficacy of these devices as aids in diagnosis and treatment of TMD. The draft Report concluded that *"Except for devices that have been developed for electromyographic biofeedback, none of the other devices intended for treatment of TMD have the scientific evidence required for their recommendations."*

These devices included jaw tracking, surface electromyography, thermography, sonography, Doppler ultrasound, muscle stimulators. It appeared that the anti-instrumentation Luddites were strategically placed politically within the American Dental Association. Disciples of the neuromuscular paradigm were armed only with facts and conviction.

The 1989 ADA Mohl Draft Status Report rejecting the safety and efficacy of transcutaneous electrical neural stimulation (TENS), jaw tracking, and electromyography, and electrosonography became the manifesto of the anti-instrumentation Luddites. Ultimately it could not hold back the tide of scientific evidence that exposed the Mohl Report as a *ad hominem* political diatribe, not a reasoned *scientific* document. Myotronics submitted a voluminous review of the scientific literature supporting the efficacy of surface

EMG, jaw tracking and low frequency TENS for diagnosis and treatment of TMD to the ADA Council on Scientific Affairs. After unprecedented scientific scrutiny these devices were ultimately awarded the ADA Council on Scientific Affairs Seal of Acceptance.

*"Manuscripts submitted to scientific journals are reviewed for validity in the same way as grant requests. And who is better qualified to judge an article than those same eminent experts with their laurels to guard?"*¹

Despite being marked **Draft Only, Not to be Referenced** and despite its rejection by the Council on Scientific Affairs the Mohl Draft Status Report appeared in over twenty refereed journals in the next six years. Many years after its rejection by the ADA Council on Scientific Affairs, the pigeon droppings from the original Draft Report trace a scatologic trail through the mainstream dental literature.²⁹⁻³⁶

Rigging of the FDA

*"In extreme cases, government agencies staffed and advised by the establishment begin legal harassment..."*¹

Failing to achieve their political agenda through the American Dental Association, the anti-instrumentation Luddites resorted to improper and illegal distortion of the regulatory process, culminating in "rigging" of the October 1994 FDA Dental Advisory Panel convened to classify *muscle monitoring devices*. An Orwellian nightmare for the manufacturers of neuromuscular instrumentation began in 1991 when an anti-instrumentation cabal subverted certain FDA employees to bring the full wrath of the FDA regulatory process upon them. The 1994 FDA Dental Advisory Panel was designed to be the death knell of neuromuscular instrumentation and ideas.

Dickinson's FDA Review³⁶ in an article entitled "Perverted' FDA: officials under criminal probe" chronicles the Machiavellian script for the panel: *"Without revealing that Myotronics' products, and similar ones made by another firm, BioResearch, were the only ones to be dealt with by the panel on a very loosely defined agenda ('muscle monitor devices,' a term that could cover over 30 other types of products as well), the FDA then appointed a notorious opponent of Myotronics' products and AADR member, State University of New York at Buffalo professor Norman Mohl as the panel's expert advisor."*

Not only did FDA conceal until the morning of the hearing its choice of old foe Bertolami to chair the hearing, but the FDA (or one of its "special government employees" on the panel) allegedly leaked Myotronics' presentation in advance to a witness who testified against the company's products.

"Myotronics and BioResearch got another shock when they saw the witness list: three well known political opponents of their technology, who had earlier fought unsuccessfully to get the American Dental