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Case Report

Bimaxillary Rehabilitation through Neuromuscular Treatment - A Case Study

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Abstract

Introduction: Patients with deep bite occlusion may experience TMD symptoms without realizing it until they begin wearing the orthotic device fitted to address this issue. These changes can be significant enough to help them recognize their symptoms and potentially restore their bite to a more physiologically stable mandibular position permanently.

Aim: To apply neuromuscular dentistry principles in bimaxillary rehabilitation using porcelain crowns for a patient exhibiting signs and symptoms of TMJ dysfunction.

Methods: The diagnostic and follow-up procedures were based on the use of mandibular tracking (CMS), SEMG, and TENS.

Results: At the 8-year follow-up, there were no TMD signs or symptoms.

Conclusion: Neuromuscular dentistry is an effective method for diagnosing TMJ disorders, which can be treated with restorative crowns and bridges.

Keywords: *Neuromuscular Dentistry; Transcutaneous Electrical Nerve Stimulator; Surface Electromyography; Bimaxillary Rehabilitation*

Abbreviations

CMS: Computerized Mandibular Scanning; EMG: Electromyography; SEMG: Surface Electromyography; TENS: Transcutaneous Electrical Nerve Stimulation; TMD: Temporomandibular Disorders; TMJ: Temporomandibular Joint

Introduction

Fixed bimaxillary reconstruction, whether using 8 or 28 crowns, involves changes to the patient's vertical dimension of occlusion. This requires the dentist to determine the most physiologically compatible mandibular position in all planes—vertical, anteroposterior, and lateral.

There are three primary indications for undertaking a reconstruction procedure that alters the vertical, anteroposterior, or lateral position of occlusion.

1. **Symptomatic patients:** Irreversible procedures should only be considered if previous provisional therapy with an occlusal orthotic device has resulted in an asymptomatic state or significant improvement that has persisted for at least four months.
2. **Self-destructive dentition:** Functional issues leading to occlusal trauma necessitate intervention to prevent further damage.
3. **Neglected dentition:** Patients with severe dental neglect, characterized by excessive caries, multiple large or inadequate restorations, and missing teeth, require comprehensive rehabilitation.

In all these cases, it is crucial to identify the source of the pathology, restore the patient's dentition to a provisional state of normalcy, establish the most optimal mandibular relationship, and accurately transfer this relationship to the final fixed reconstruction.

How can we accurately diagnose and determine the proper mandibular position and then transfer it into a permanent restoration? A neuromuscular approach may provide the solution. This method utilizes bioelectrical instrumentation, including computerized mandibular scanning (CMS), surface electromyography (SEMG), and transcutaneous electrical nerve stimulation (TENS) to evaluate and establish an optimal mandibular position.

In the case described here, mandibular range of motion was assessed using the K7 Evaluation System (Myotronics-Noromed, Inc., Kent, WA, USA). This system comprises the K7 Computerized Mandibular Scanner (CMS), the K7 Electromyograph (EMG), and the K7 Electrosonography (ESG) for joint sound recording. The K7 system enables the simultaneous evaluation of mandibular movements and function. Its software allows clinicians to analyze electromyographic activity in specific muscles during various mandibular actions, such as clenching or mouth opening.

The J5 Myomonitor TENS unit (Myotronics-Noromed, Inc.) was also utilized in this study. This low-frequency TENS device delivers bilateral electrical stimulation to the trigeminal (V) and facial (VII) cranial nerves through electrodes placed on the coronoid notch. A third, neutral electrode is positioned equidistant from the first two, behind the lower neck. This system helps facilitate the natural physiological responses necessary to record the optimal mandibular-cranium relationship. By doing so, it provides valuable diagnostic information that can assist practitioners in treatment planning [1-12].

Case Report

Diagnosis and etiology

A 35-year-old male patient presented to the practice with a chief complaint of repeatedly breaking restorations and teeth. He had lost confidence in his previous dentist's ability to restore his teeth without further fractures.

Dental history: The patient reported frequent headaches and neck pain, primarily in the mornings, as well as ongoing issues with broken teeth and restorations. He also described a history of poor sleep, averaging only 4-5 hours per night. Additionally, he experienced chronic sinus infections throughout the year, which were more severe during colder months. However, he did not associate these symptoms with his dental malocclusion, severe bruxism, or clenching.

Clinical examination: An intraoral assessment revealed significant muscular hypertrophy in the muscles of mastication and the postural muscles of the neck. The patient exhibited severe occlusal wear (Figure 1) due to nighttime grinding, which he was unaware of. Additionally, he presented with noticeable ptosis of the right eye (Figure 1a).

The patient was evaluated and treated using K7 Myotronics Instrumentation and TENS to assess the muscular, dental, and temporomandibular joint health of the head and neck. The evaluation focused on:

Figure 1: *Severe tooth wear with abfractions and gingival recession.*

Figure 1a: *Patient with ptosis.*

- Mandibular-cranial relationship: Establishing the optimal physiologic mandibular position using ultra-low frequency TENS.
- Muscle function analysis: Assessing the state of muscles at rest and in function before and after treatment, measured in millivolts (mV) using EMG.
- Jaw movement and positioning: Tracking mandibular movements in the frontal and sagittal planes and determining the physiologic mandibular position in space using CMS.

Figure 2 shows EMG Scan 9, where the patient's muscle activity should ideally be much lower. However, due to hypertrophic muscles, the patient struggled to achieve light tooth contact. These muscles either overcompensated, leading to excessive occlusal force, or undercompensated, preventing proper occlusal contact.

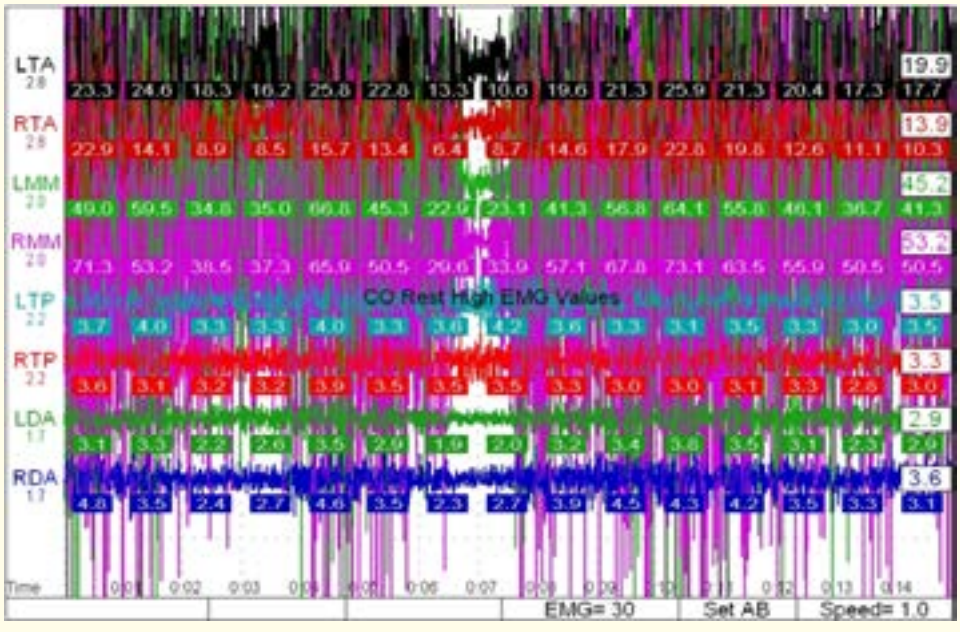

Figure 2: *Diagnostic scan 9 - EMGs with resting occlusion (however, the patient was only able to have either heavy contact or no contact).*

Treatment objectives

Phase 1 treatment commenced with the placement of a fixed orthotic to restore the lost vertical dimension, anteroposterior positioning, lateral mandibular planes, and the retruded jaw position. The patient would wear the orthotic for 4 - 6 months in an asymptomatic state before determining the next steps for Phase 2 treatment.

Treatment progress

Figure 3 illustrates the habitual trajectory vs. Myo-trajectory of the mandibular jaw position relative to centric occlusion (CO) after TENS, as recorded in Scan 4/5 (measured in millimeters) using jaw tracking.

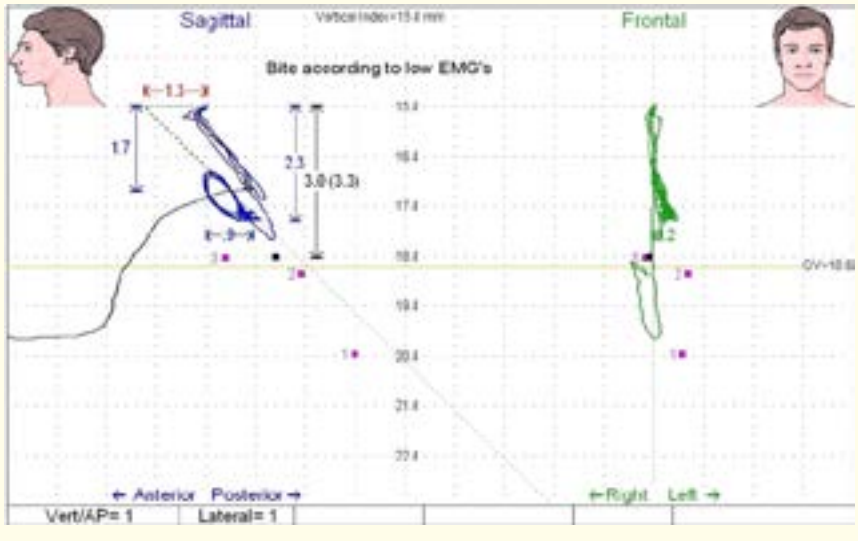

Figure 3: *Scan 4/5 with new Myo-trajectory and new bite position at black point.*

The bite position was recorded at the black point just below the Golden Vertical, where the patient's muscles were in their most relaxed state. In this position, the mandible moved forward by 1.3 mm and opened by 3 mm, resulting in:

- Decompression of the jaw joint.
- Increased tongue space.
- A downward and forward repositioning of the mandible.

This optimized position contributed to improved neuromuscular balance and overall function.

The neuromuscular bite position (Figure 4) was mounted and articulated to create a wax-up for the fixed neuromuscular orthotic device (Figure 5) with balanced occlusion. The orthotic was worn for four months, during which the patient attended several appointments for diagnostic evaluations and bite equilibration using TENS and Myotronics K7 instrumentation.

Figure 4: *Neuromuscular bite position.*

Figure 5: *Neuromuscular orthotic wax-up.*

The results were significant-most of the patient's symptoms resolved almost immediately after the insertion of fixed neuromuscular orthotic (Figure 6). His headaches and neck pain subsided, and his sleep quality and duration improved (averaging 7-8 hours per night). The patient also reported feeling a renewed sense of energy and overall well-being.

Figure 6: *Fixed neuromuscular orthotic device placed intraorally.*

Phase 2 treatment:

1. No additional treatment, with the patient wearing a removable orthotic at night only.
2. Orthodontic treatment to establish a stable occlusion.
3. Combination of orthodontic treatment with crown and bridge work for optimal function and aesthetics.
4. Full or partial mouth reconstruction with crowns to permanently restore occlusion and function.

After wearing the orthotic for four months, the patient decided to restore both the function and aesthetics of his bite with porcelain crowns on all teeth.

Permanent neuromuscular bite transfer with ceramic restorations

The bimaxillary rehabilitation was prepared and temporized in a single appointment, with the final restorations delivered two weeks later, while maintaining the same precise neuromuscular bite position.

A total of 24 IPS E-max pressed lithium disilicate crowns (Ivoclar) were used, featuring facial cutbacks in the esthetic zone for enhanced aesthetics.

After the equilibration of permanent crowns, final K7 scans were performed to assess the resulting bite position. The pre-treatment and post-treatment (bimaxillary rehabilitation) scans demonstrated a transformation into an ideal physiological state, showing balanced muscle function in the head and neck and remodeled jaw joints for improved function (Figure 7).

Figure 8 confirms that the new bite position, with the restored maxillary and mandibular arches, follows the correct bite trajectory.

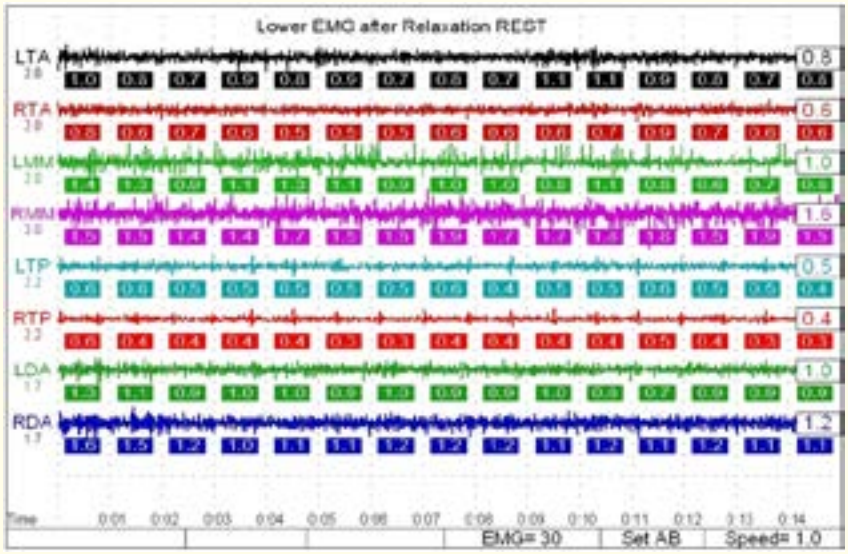

Figure 7: *Scan 10 - ideal resting EMGs after bimaxillary rehabilitation.*

Figure 8: *Scan 4/5 for pre- vs. post-treatment myo-trajectory comparison.*

Figure 9 illustrates the range of motion of the mandible before and after treatment, revealing a significant improvement. Pre-treatment Scan 13 (frontal section) indicated a 12.9 mm deviation to the left, whereas the post-treatment scan demonstrated a nearly vertical movement with balanced left and right motion. The post-treatment scan (obtained at the time of crown delivery) nonetheless revealed a slight reciprocal click, which later resolved spontaneously, likely due to joint inflammatory healing.

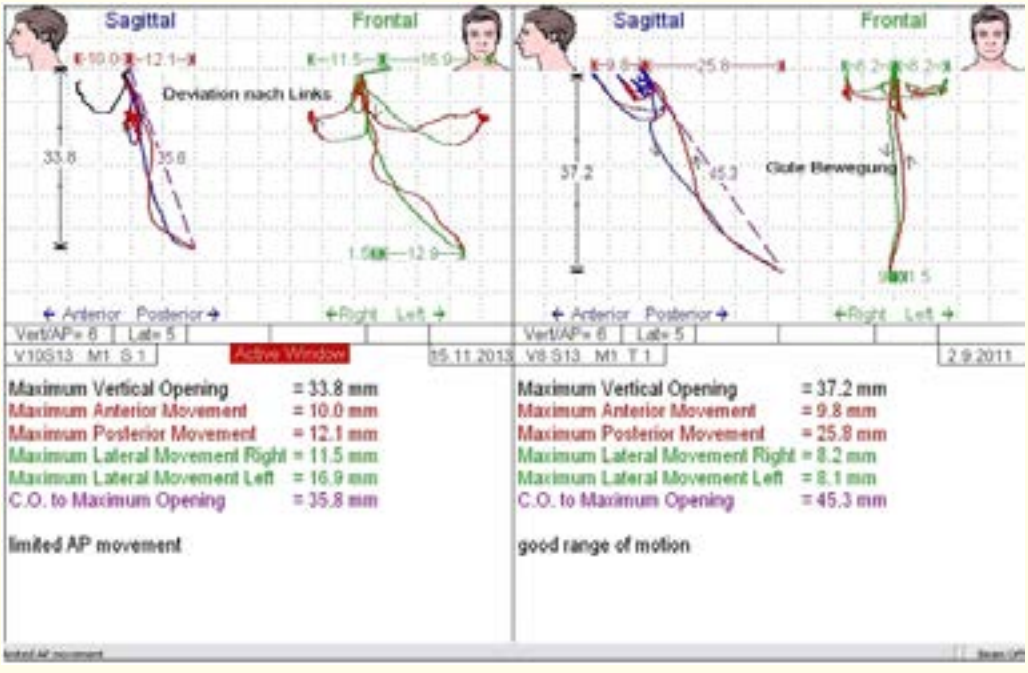

Figure 9: *Scan 13 comparing mandibular range of motion before and after treatment.*

Figure 10 and 11 demonstrate that the bite was relaxed at rest, with a slight increase in muscle recruitment during clenching.

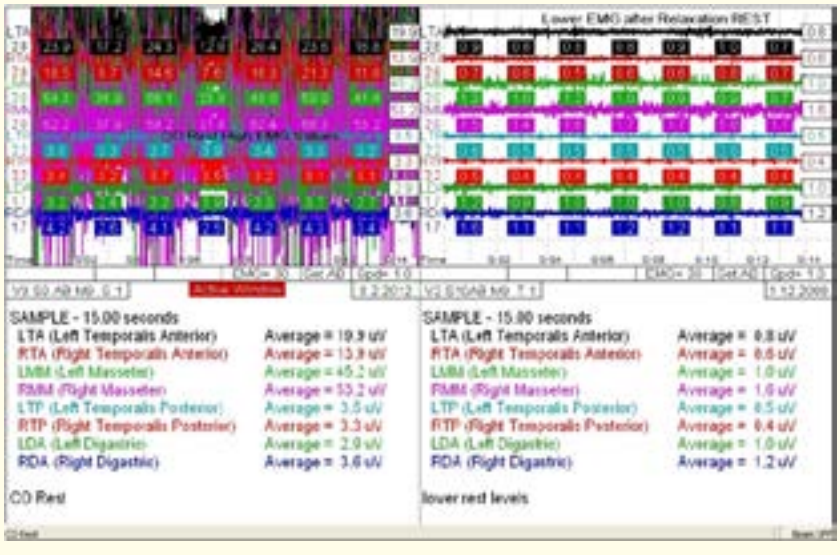

Figure 10: *Scan 9 (pre-treatment) compared with scan 10 (post-treatment).*

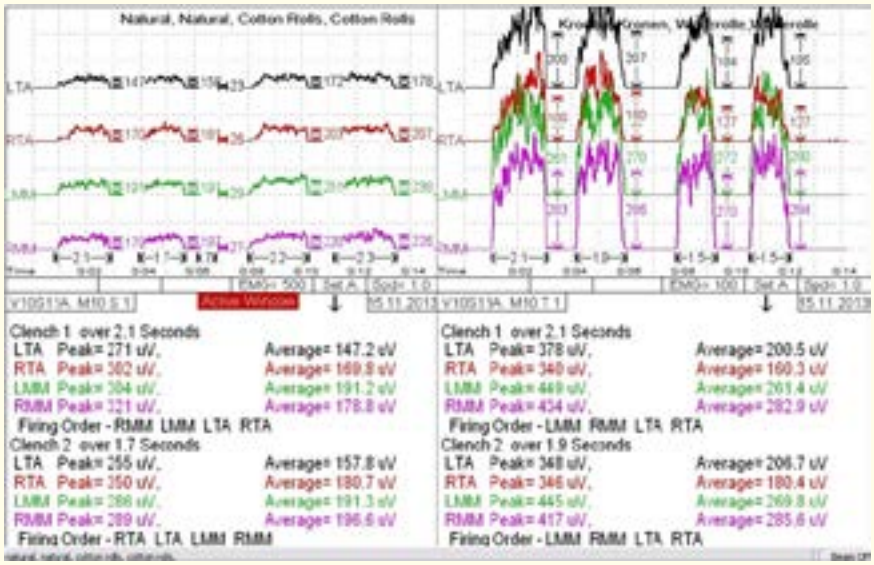

Figure 11: *Scan 11 captured for pre- vs. post-treatment comparison.*

Figure 12 shows a notable improvement in chewing function, with freedom of movement on both sides in the frontal plane, indicating a balanced occlusion.

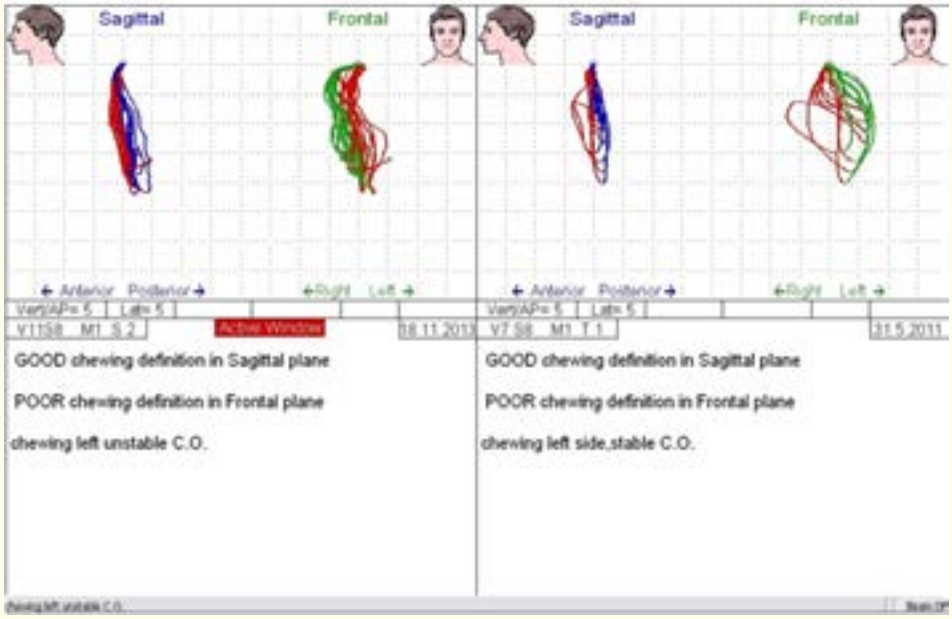

Figure 12: *Scan 8 captured for left-side chewing comparison.*

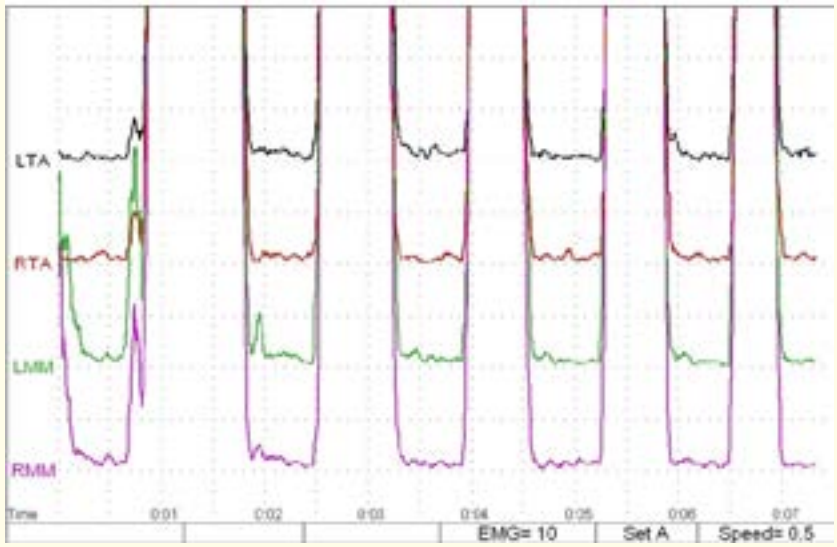

Figure 13: *Scan 12 showing the quality of muscle balance timing and recruitment after bimaxillary rehabilitation.*

Figure 14 presents before and after images of the restored dentition in its new physiological bite position.

Figure 14: *Before and after photos of restored bimaxillary rehabilitation.*

Over the six-month treatment period—which included wearing the orthotic, undergoing rehabilitation, and completing occlusal equilibration—the patient stopped experiencing sinus infections, in stark contrast to his prior years of recurring infections and repeated antibiotic use.

Although initially skeptical, the patient eventually recognized that his improved bite and tongue position had a systemic effect on his nighttime breathing. The cessation of clenching and grinding reduced inflammation in his stomatognathic and olfactory systems, contributing to the complete resolution of his sinus infections.

Beyond the functional improvements, the patient also noticed a significant enhancement in his overall well-being. He particularly appreciated that he appeared more awake and that his right-eye ptosis had nearly disappeared.

Figure 15: *Pre- and post-rehabilitation images: frontal, profile, smile, maxillary and mandibular.*

Conclusion

Neuromuscular dentistry is highly effective because it focuses on achieving optimal jaw alignment by considering the interplay between teeth, muscles, and nerves. Unlike traditional dentistry, which primarily addresses the teeth and bite, neuromuscular dentistry utilizes advanced diagnostic instrumentation to assess muscle activity and jaw positioning, leading to a more balanced and comfortable occlusion.

This approach helps alleviate TMJ disorders, headaches, muscle pain, and other systemic conditions by restoring proper function and physiological balance. As demonstrated in this case, neuromuscular dentistry can provide long-term relief, enhance overall oral health, and contribute to improved quality of life.

Bibliography

1. Farrar WB. "Differentiation of temporomandibular joint dysfunction to simplify treatment". *Journal of Prosthetic Dentistry* 28.6 (1972): 629-636.

2. Farrar WB and WL McCarty. "Inferior joint space arthrography and characteristics of condylar paths in internal derangements of the TMJ". *Journal of Prosthetic Dentistry* 41.5 (1979): 548-555.

3. Farrar WB and WL McCarty. "A clinical outline of temporomandibular joint diagnosis and treatment". 7th edition. Montgomery, Ala. (2119 E.S. Blvd., Montgomery 36199): Normandie Study Group for TMJ Dysfunction (1982): 182.

4. Jankelson RR., *et al*. "Neuromuscular dental diagnosis and treatment". *American Journal of Orthodontics and Dentofacial Orthopedics* 99.3 (1991): 283-284.

5. Jankelson B. "Neuromuscular aspects of occlusion. Effects of occlusal position on the physiology and dysfunction of the mandibular musculature". *Dental Clinics of North America* 23.2 (1979): 157-168.

6. Jankelson B. "Measurement accuracy of the mandibular kinesiograph—a computerized study". *Journal of Prosthetic Dentistry* 44.6 (1980): 656-666.

7. Jankelson B., *et al*. "The physiology of the stomatognathic system". *Journal of the American Dental Association* 46.4 (1952): 375-386.

8. Jankelson B., *et al*. "Kinesiometric instrumentation: a new technology". *Journal of the American Dental Association* 90.4 (1975): 834-840.

9. Weinberg LA. "The role of muscle deconditioning for occlusal corrective procedures". *Journal of Prosthetic Dentistry* 66.2 (1991): 250-255.

10. Hugger A., *et al*. "Surface electromyography of the masticatory muscles for application in dental practice. Current evidence and future developments". *International Journal of Computerized Dentistry* 11.2 (2008): 81-106.

11. Hugger S., *et al*. "Surface EMG of the masticatory muscles (Part 3): Impact of changes to the dynamic occlusion". *International Journal of Computerized Dentistry* 16.2 (2013): 119-123.

12. Schindler HJ., *et al*. "T.E.N.S. (transcutaneous electroneurostimulation), a myofunctional concept for oral rehabilitation (II)". *Quintessenz* 33.2 (1982): 295-307.

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