

# Neuromuscular Dentistry - Vision of Tomorrow

Gayatri Mehrotra<sup>1</sup>, Bhushan S Ahire<sup>1</sup>, Ajay R Bhoosreddy<sup>2</sup>, Seema Bhoosreddy<sup>3</sup>

<sup>1</sup>PG Student, Department of Oral Medicine and Radiology, MGV's KBH Dental College and Hospital, Nashik, Maharashtra, India, <sup>2</sup>Professor and Head, Department of Oral Medicine and Radiology, MGV's KBH Dental College and Hospital, Nashik, Maharashtra, India, <sup>3</sup>Professor, Department of Oral and Maxillofacial Surgery, MGV's KBH Dental College and Hospital, Nashik, Maharashtra, India

## ABSTRACT

Temporomandibular disorder (TMD) is the most frequently encountered problem which we come across in our daily practice. It is a multifactorial etiological disorder with various factors such as psychological factors, macrotrauma, and microtrauma responsible for it. A number of treatment modalities have been recommended for it with none of them being specific enough to cure the disorder. Neuromuscular dentistry is a new approach to the diagnosis and treatment of TMDs. This approach is all about the complex relationship among temporomandibular joint, masticatory muscles, and teeth to achieve neuromuscular occlusion. It involves various diagnostic tools such as electromyography, electrosonography, computerized mandibular scanning, and cone-beam computed tomography and therapeutic tools, which include transcutaneous electrical nerve stimulation and occlusal splints.

**Keywords:** Electromyography, Neuromuscular dentistry, Temporomandibular disorder, Transcutaneous electrical nerve stimulation, Treatment

**Corresponding Author:** Dr. Gayatri Mehrotra, 240 Nehru Nagar, Agra - 282 002, Uttar Pradesh, India. Phone: +91-9765360608. E-mail: drgayatri.mehrotra@gmail.com

## INTRODUCTION

The temporomandibular joint (TMJ) is one of the most complex and most functionally used joints in the body, and it is the only bilateral joint, in which both the sides function at the same time. Temporomandibular disorders (TMDs) comprise of a number of musculoskeletal disorders affecting the structure or function of one of the following - TMJ, masticatory muscles, teeth, and supporting structures.<sup>1</sup> So, TMD is a cycle of pain and muscle spasm, which occurs when your teeth, jaw joints, and muscles do not work together in harmony, that is, balance among the joints, teeth, and muscles are lost.

TMD is a multifactorial etiological disorder. Any local or systemic factor might affect the normal activity of the masticatory system.<sup>2</sup> Factors causing TMD may include psychological factors such as stress and macrotrauma, i.e., any sudden force to the joint or microtrauma including bruxism and occlusal instability.<sup>2-4</sup> Dental occlusion is the cornerstone for the stability of the craniomandibular system. Malocclusion is a destabilizing factor and thus a predisposing factor for TMD. Pathological occlusal wear and tooth fracture are multifactorial involving attrition,

abrasion, and erosion. In cases, where excessive occlusal wearing is seen, occlusal disorder should be suspected independent of etiology.<sup>5,6</sup> Tooth hypermobility and dentin hypersensitivity are also seen in some cases indicating occlusion to be an etiological factor. A number of studies have determined the role of occlusion as a predisposing or initiating factor in the etiology of TMD.<sup>6-17</sup>

According to De Boever *et al.*, artificially introduced occlusal interferences cause contraction of jaw muscles leading to jaw muscle hyperactivity and pain in some cases.<sup>18</sup>

The relationship between dental occlusion, body posture, and TMD is a controversial topic till date. The TMJ is linked to both cervical as well as scapular region via an interrelated neuromuscular system. So, the changes in the cervical spine can lead to TMD and vice versa. Any alteration done in muscles of mandible, in turn, produces changes in the usual head posture.<sup>19</sup> A number of associations have been found between the cervical spine and craniofacial region, i.e., anatomic, biomechanical, neurological, and pathological.<sup>20</sup>

## SIGNS AND SYMPTOMS OF TMD

The success of treatment of TMD depends on how accurately the diagnosis is done.<sup>21</sup> For this, a detailed examination of each component of the masticatory system needs to be done which would include an examination of masticatory muscles, TMJ, and occlusal complex. Costen was the first to recognize signs and symptoms of TMDs in 1934.<sup>22</sup> TMD is characterized by one or more of the following signs or symptoms: Pain, joint sounds, limitation in joint movement, muscle tenderness, and joint tenderness.<sup>23</sup> Apart from these, it is also associated with other symptoms such as a headache, ear-related symptoms (tinnitus in which there is ringing of ears), facial pain, neck and shoulder pain, and cervical spine disorders.<sup>24,25</sup> Tinnitus is basically heard because of bone destruction which, in turn, compresses the eustachian tube, which equalizes pressure in the ear. Patients suffering from chronic TMD experience symptoms of depression, poor sleep quality and have low energy. Pain is the most common complaint which we come across in TMD patients.<sup>26</sup> Clicking sound is another common symptom seen; however, it does not have much significance in the absence of pain. Another symptom is the limited range of jaw movement in all directions. This, in turn, encounters the problem in everyday activities of the patient such as eating and speech. A number of treatment modalities have been recommended for treatment of TMD. All methods are categorized into two main groups:

- a. Definitive treatment
- b. Supportive therapy.<sup>27</sup>

Definitive treatment aims at eliminating the etiological factors, and on the other hand, supportive therapy directs toward alleviating the symptoms. Relieving the muscle spasm and pain is the main aim of any treatment modality to improve the quality of life. Occlusal adjustments, orthodontics, prosthodontics rehabilitation, and joint surgery are some of the treatment approaches. From some of the systematic reviews, it has been found that use of a stabilization splint in case of TMD causes only short-term improvement in comparison to placebo.<sup>28</sup>

## NEUROMUSCULAR DENTISTRY (NMD)

NMD is a new approach to the diagnosis and treatment of TMD. The objective of NMD is to evaluate the complex relationship among teeth, TMJ, and masticatory muscles to achieve an occlusion that is based on the optimal relationship between mandible and skull that is the neuromuscular occlusion. The goal of NMD is to relax the muscles controlling the jaw position to obtain a physiologic rest position on which further treatment considerations are based. Hence, it is the

science of occlusion which not only includes teeth but also evaluates status and function of jaw muscles and joints both before and after treatment.<sup>27,29,30</sup> Thus, all the three components are taken into consideration as an interdependent unit (Figure 1).

Dr. Bernard Jankelson is known as "Father of NMD."<sup>31</sup> Dr. Bernard with his son Robert Jankelson has contributed a lot in the field of NMD.

Occlusion forms the foundation of dentistry. Hence, it is of utmost importance for any dental procedure to be successful. Occlusion is affected by the triad of factors - the teeth, muscles, and TMJ.

NMD has a number of applications which are as follows:

1. Focusing on the importance of musculoskeletal occlusal signs and symptoms as they are related to the patient's postural issues of head, neck, position of mandible, and temporomandibular position, and these, in turn, affect the occlusion and position of teeth.<sup>31</sup>
2. Occlusal problems are taken into consideration because they have an impact on the status of masticatory muscles.<sup>32</sup>
3. Utilizes various diagnostic instrumentations to obtain an accurate physiologic rest position which, in turn, is helpful in obtaining centric occlusion.
4. Helps to determine the various mandibular imbalances during the closure of mandible and thus help in correcting the micro-occlusion.<sup>31</sup>
5. Determines neuromuscular trajectory along an isotonic pathway for the maintenance of stability at the contact position.

## THE DIFFERENCE BETWEEN TRADITIONAL DENTISTRY (TD) AND NMD

The primary element, which sets NMD apart from TD, is that NMD considers the nerves and muscles and the correct positioning of the jaw, whereas TD just focuses on teeth and joints. Therefore, on one hand, TD is referred to as "one-dimensional" dentistry, whereas NMD considers "second and third-dimensions" as well, that is, muscles and TMJ.<sup>28,30</sup> Various diagnostic and therapeutic tools included in NMD are given in Table 1.

## DIAGNOSTIC TOOLS

### Electromyography (EMG)

It is the study of the status of muscle activity using surface electrodes. The electrodes are placed on the face, forehead, side of the head, and beneath the chin. Its working mechanism involves picking up of tiny signals coming through the skin which are the representatives

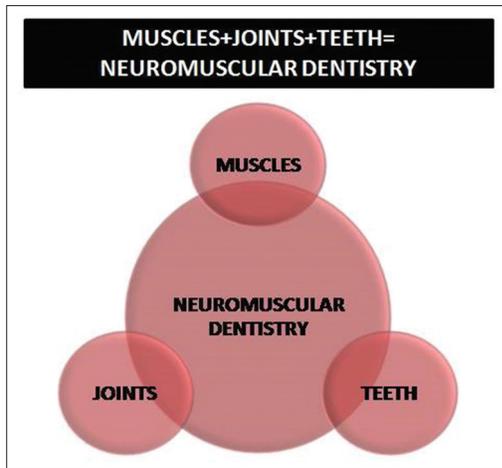


Figure 1: What is neuromuscular dentistry

Table 1: Neuromuscular diagnostics and therapeutics

Diagnostic tools	Therapeutic tools
EMG	TENS
ESG	Occlusal splint
CMS	
CBCT	

EMG: Electromyography, ESG: Electrosonography, CMS: Computerized mandibular scanning, CBCT: Cone-beam computed tomography, TENS: Transcutaneous electrical nerve stimulation

of the average of multiple fibers of a given muscle. The data, which are obtained through these electrodes, are then transferred to the computer where it is displayed. EMG helps to measure and analyze the electrical activity in the muscles. The evaluation is done both at rest and during the function. It helps to evaluate the muscle activity both before and after transcutaneous electrical nerve stimulation (TENS) therapy.

### Electrosonography (ESG)

It is also known as “joint vibration analysis.” It works on a computer-based technology, i.e., vibration sensitive transducer technology where sounds which are produced within the jaw joint are recorded both during opening and closing of the mouth. The patient is made to wear headpiece which is similar to that of a headset with vibration sensors placed over the two TMJs. It not only helps in knowing the frequency and amplitude of the noise but also the position of the condyle during the opening/closing of the jaw at which sound is produced is known. ESG is essential because the sound transmission through the bones is so fast that unilateral study of joint sound with the help of stethoscope would not even disclose as to which side the sound is coming from.

### Computerized Mandibular Scanning

It is a jaw tracking device which helps in identifying the relationship between the mandible and skull. It also

analyzes the delicate functioning movements of the jaw with accuracy up to one tenth of a millimeter. It utilizes a tiny magnet which is placed on the gums below the mandibular incisors. Sensors then track the path of the mandible by sensing the magnetic field changes. Thus, it helps to evaluate the accuracy of jaw position after the treatment, for evaluation of occlusion.

### Cone-beam Computed Tomography (CBCT)

CBCT would help in upper airway evaluation, cervical vertebra, TMJ morphology, and condylar position as these factors play a role in TMD directly or indirectly.

## THERAPEUTIC TOOLS

### TENS

It helps in the relaxation of muscles. TENS is a widely used term, so in ND, it is more accurately called as ultra-low frequency electrical muscle stimulation. It is a safe battery operated device in which a mild electrical stimulus is delivered to the muscles via the neural pathway. There is an involuntary contraction of the muscles controlled by the facial nerve (7<sup>th</sup>) and trigeminal nerve (5<sup>th</sup>). It is necessary to relax the tensed muscles to find their true resting state and establish occlusion at that position.

### Occlusal Splints

Occlusal splint therapy is defined as “the art and science of establishing neuromuscular harmony in the masticatory system by creating a mechanical disadvantage for parafunctional forces with removable appliances.” It helps in protecting the teeth from undergoing excessive wear in cases like bruxism. They are thus helpful in treating patients with TMD symptoms. It performs following functions:

- i. Protects oral tissues in patients having habits like bruxism
- ii. Helps to stabilize the unstable occlusion
- iii. Provides muscle relaxation
- iv. Helps in eliminating the occlusal interferences.

Apart from occlusal splints, other treatment modalities such as coronoplasty (reshaping of enamel for correction of bite) and orthodontics (braces) can also be opted depending on the requirement of the patient.

## CONCLUSION

Today, when there has been no particular treatment for TMD, here ND acts a new ray of hope which helps in treating the TMD by creating a balance between the joints, bite, and muscles. ND concerns itself with how a proper, aligned bite affects not only head, neck, and

jaw but also patients' health as a whole. NMD is a recent practicing trend in dentistry. Thus, it would enlighten the people with a new scope for the treatment of TMD.

## REFERENCES

- Cooper BC. International college of cranio-mandibular orthopedics (ICCMO). Temporomandibular disorders: A position paper of the international college of cranio-mandibular orthopedics (ICCMO). *Cranio* 2011;29:237-44.
- Okeson JP. Management of Temporomandibular Disorders and Occlusion. 5<sup>th</sup> ed. St. Louis: Mosby; 2003.
- Oral K, Bal Küçük B, Ebeoglu B, Dinçer S. Etiology of temporomandibular disorder pain. *Agri* 2009;21:89-94.
- Licini F, Nojelli A, Segù M, Collesano V. Role of psychosocial factors in the etiology of temporomandibular disorders: Relevance of a biaxial diagnosis. *Minerva Stomatol* 2009;58:557-66.
- Grippio JO, Simring M, Schreiner S. Attrition, abrasion, corrosion and abfraction revisited: A new perspective on tooth surface lesions. *J Am Dent Assoc* 2004;135:1109-18.
- Abrahamsen TC. The worn dentition - Pathognomonic patterns of abrasion and erosion. *Int Dent J* 2005;55 4 Suppl 1:268-76.
- Kirveskari P, Alanen P, Jamsa T. Association between craniomandibular disorders and occlusal interferences. *J Prosthet Dent* 1989;62:66-9.
- Fushima K, Akimoto S, Takamoto K, Kamei T, Sato S, Suzuki Y. Incidence of temporomandibular joint disorders in patients with malocclusion. *Nihon Ago Kansetsu Gakkai Zasshi* 1989;1:40-50.
- Raustia AM, Pirttiniemi PM, Pyhtinen J. Correlation of occlusal factors and condyle position asymmetry with signs and symptoms of temporomandibular disorders in young adults. *J Craniomandibular Pract* 1995;13:152-6.
- Raustia AM, Pyhtinen J, Tervonen O. Clinical and MRI findings of the temporomandibular joint in relation to occlusion in young adults. *Cranio* 1995;13:99-104.
- Liu JK, Tsai MY. Association of functional malocclusion with temporomandibular disorders in orthodontic patients prior to treatment. *Funct Orthod* 1998;15:17-20.
- Kirveskari P, Jamsa T, Alanen P. Occlusal adjustment and the incidence of demand for temporomandibular disorder treatment. *J Prosthet Dent* 1998;79:433-8.
- Sonnenes L, Bakke M, Solow B. Malocclusion traits and symptoms and signs of temporomandibular disorders in children with severe malocclusion. *Eur J Orthod* 1998;20:543-59.
- Celic R, Kraljevic K, Kraljevic S, Badel T, Panduric J. The correlation between temporomandibular disorders and morphological occlusion. *Acta Stomatol Croat* 2000;34:35-40.
- Kirveskari P, Alanen P, Jämsä T. Association between craniomandibular disorders and occlusal interferences in children. *J Prosthet Dent* 1992;67:692-6.
- Klopogge MJ, van Griethuysen AM. Disturbances in the contraction and co-ordination pattern of the masticatory muscles due to dental restorations. An electromyographic study. *J Oral Rehabil* 1976;3:207-16.
- Bcitollahi JM, Mansourian A, Bozorgi Y, Farrokhnia T, Manavi A. Evaluating the most common etiologic factors in patients with temporomandibular disorders: A case control study. *J Appl Sci* 2008;8:4702-05.
- De Boever JA, Carlsson GE, Klineberg IJ. Need for occlusal therapy and prosthodontic treatment in the management of temporomandibular disorders. Part 1. Occlusal interferences and occlusal adjustment. *J Oral Rehabil* 2000;27:367-79.
- Huggare JA, Raustia AM. Head posture and cervicovertebral and craniofacial morphology in patients with craniomandibular dysfunction. *Cranio* 1992;10:173-7.
- Armijo Olivo S, Magee DJ, Parfitt M, Major P, Thie NM. The association between the cervical spine, the stomatognathic system, and craniofacial pain: A critical review. *J Orofac Pain* 2006;20:271-87.
- Dos Santos J. Occlusion - Principles and Treatment. London: Quintessence Publishing Co., Ltd.; 2007.
- Costen JB. A syndrome of ear and sinus symptoms dependent upon disturbed function of the temporomandibular joint 1934. *Ann Otol Rhinol Laryngol* 1997;106:805-19.
- Benoit P. History and physical examination for TMD. In: Kraus SL, editor. *Temporomandibular Disorders*. 2<sup>nd</sup> ed. New York, NY: Churchill Livingstone; 1994. p. 71-98.
- Gremillion HA. The prevalence and etiology of temporomandibular disorders and orofacial pain. *Tex Dent J* 2000;117:30-9.
- de Wijer A, de Leeuw JR, Steenks MH, Bosman F. Temporomandibular and cervical spine disorders. Self-reported signs and symptoms. *Spine (Phila Pa 1976)* 1996;21:1638-46.
- Okeson JP. *Bell's Orofacial Pain*. 5<sup>th</sup> ed. Chicago: Quintessence Publishing Co., Inc.; 1995.
- Dickerson W, Chan C, Mazzocco M. The scientific approach to neuromuscular occlusion. *Signature* 2000;7:14-7.
- Al-Ani MZ, Davies SJ, Gray RJ, Sloan P, Glenn AM. Stabilisation splint therapy for temporomandibular pain dysfunction syndrome. *Cochrane Database Syst Rev* 2004;CD002778.
- Jankelson B. Neuromuscular aspects of occlusion. Effects of occlusal position on the physiology and dysfunction of the mandibular musculature. *Dent Clin North Am* 1979;23:157-68.
- Jankelson RR. *Neuromuscular Dental Diagnosis & Treatment*. St. Louis, MO: Ishiyaku EuroAmerica; 2005.
- Jankelson RR. *Neuromuscular Dental Diagnosis and Treatment, Temporomandibular Joint Musculoskeletal Dysfunction*. St. Louis: Ishiyaku EuroAmerica, Inc., Publishers, Dedication; 1990.
- Wilke DR. *Muscle, Studies in Biology*. 2<sup>nd</sup> ed. London: A Edward Ltd.; 1979.

**How to cite this article:** Mehrotra G, Ahire BS, Bhoosreddy AR, Bhoosreddy S. Neuromuscular Dentistry - Vision of Tomorrow. *Int J Adv Health Sci* 2016;3(1):11-14.

**Source of Support:** Nil, **Conflict of Interest:** None declared.