

Methods of Recording Mandibular Movements

[1] Priya.G, [2] Dr.Nirmal Famila Betty.MDS, [3] Dr.Rathika Rai. MDS
[2] Associate Professor, [3] Professor, Head Of The Department
[1][2][3] Department Of Prosthodontics, Thai Moogambigai Dental College And Hospital,
Mogappair,,Chennai.

ABSTRACT

The craniofacial skeletal complex has one movable bone, the mandible. The mandibular movements are made possible by the temporomandibular joint and the facial muscles. The mandibular movements are affected by various etiological factors which can be congenital and acquired. During replacement of missing teeth, recording maxillomandibular relation often poses a difficulty. Restoring exact vertical dimension and centric relation contributes to a harmonious occlusion. Various methods of recording mandibular movements are available.

INTRODUCTION

The craniofacial skeletal complex has one movable bone, the mandible. The mandibular movements are made possible by the temporomandibular joint and the facial muscles. The temporomandibular joint consists of the articulating bony surfaces, the articular disc, ligaments and the head of the condyle. The mandibular movements are facilitated by the temporomandibular joint and the mandibular bone¹. The mandibular movements are affected by various etiological factors which can be congenital and acquired. Congenital factors are hyperplasia, hypoplasia, hypognathia etc. Acquired factors are trauma and tumors. The mandibular movement is made possible by the muscles attached to the mandible and TMJ, the TMJ ligaments and the articular disc². During replacement of missing teeth, recording maxillomandibular relation often poses a challenge. Restoring exact vertical dimension and centric relation contributes to a harmonious occlusion. The consequence of obstructed mandibular movement is a false recording of vertical and centric jaw relation. Various methods of recording mandibular movements are available. This article analyses various methods and their advantages, indications and their reliability.

STATIC METHODS: INDICATIONS

Static method is indicated in patients with irregular

jaw movement, in patients with difficulty in opening and closing the mouth, TMJ Pain, clicking sounds in jaw joints while opening and closing. Methods like SICAT displays jaw movements in three dimensions. Based on this, the user can analyze the finding, plan treatment, and an appropriate appliance. It is also indicated to measure the volume and surface of the condyle, to merge the data from JMT with CBCT using the SICAT software, to record and to locate the mandibular movements³.

DISADVANTAGES

There are many disadvantages in Static methods. The jaw movements could not be fully described from the data obtained from Static methods. The position and the pathology of the TMJ and mandible are seen in static methods, the movement of the mandible and the joint cannot be tracked using static method.

METHODS USING MECHANICAL DEVICES: JOINT VIBRATION ANALYSIS

Joint vibration analysis is a mechanical device used to record the dynamic movements of the mandible it works by the mechanism to evaluate and record the presence, location, loudness, timing, consistency, and quality of joint vibrations. This analysis is important

to determine and diagnose temporomandibular disorders. Every joint disease has its own characteristics sounds and vibrations^{2, 3}.

It is indicated for better understanding of any joint pathology, joint function in particular patient, diagnosis of existing joint pathology, correct existing bite problems, prevent exacerbation of pre-existing joint issues, prevent new bite problems due to any recommended dentistry.

EMG

Electromyography (EMG) is the science of recording the electrical activity of muscle fibers. It is a diagnostic procedure that assesses the health of muscles and the nerve cells that control them (motor neurons). The results can reveal nerve dysfunction, muscle dysfunction or problems with nerve-to-muscle signal transmission, it records bilateral simultaneous measurement of the craniomandibular muscles².

EMG is used as a diagnostics tool for identifying neuromuscular diseases, or as a research tool for studying kinesiology, and disorders of motor control. EMG signals are sometimes used to guide botulin toxin or phenol injections into muscles. EMG signals are also used as a control signal for prosthetic devices⁴.

The disadvantage of EMG is that the patients with lymphedema or patients at risk for lymphedema are routinely cautioned to avoid percutaneous procedures in the affected extremity, namely venepuncture, to prevent development or worsening of lymphedema or cellulitis

EGN

EGN is the test can measure and record mandibular movement using a jaw tracking sensor array. Three dimensions of movement can be measured: vertical, anterior/Posterior and lateral translations or movements. The active muscle during mastication is given by masticatory muscle (anterior-temporalis and masseter). Jaw movement velocity and trajectory to characterize the chewing behavior can be recorded by Electrognathography (EGN) during mastication, significant differences in sensory attributes, muscle activities, and jaw movements among subjects⁵.

It is indicated to corroborate the neuropsychological analysis of the factors linked to prosthetic rehabilitation procedures. T Scan The T-Scan system is a valuable tool that aids in the diagnostic process of analyzing a patient's bite and functional status properly. When a bite is unstable it can cause pain, teeth and dental restorations to crack and break, gum disease, tooth loss, headaches, and TMJ Disorder. Using the T-Scan sensor, we can record muscle activity during clenching, muscle strength, muscle symmetry or asymmetry, firing time, and bite force⁶. It is used to analysis of contact marks made in intercuspation, dynamic analysis, searching for interferences in centric relation

The disadvantage of Tscan is that it has limited application in patients with increased mobility of teeth associated with an enlargement of the periodontal ligament, a decrease in the visibility of the lamina dura, a loss of alveolar bone.

RANGE OF MOTION (ROM)

Most studies show that the maximum jaw range of motion (ROM) or maximum mouth opening (MMO) is related to body size and height. Men can usually open wider than women, taller people more than shorter people. In studies, MMO for adults has generally been around 42 mm⁷.

It is indicated in correlation of mandibular movement to excursive or lateral movements for a healthy population.

TENS

Bio TENS is a compact, Ultra-Low Frequency, Transcutaneous Electrical Neural Stimulator (ULF-TENS). This test (Transcutaneous Electrical Neural Stimulation) delivers a precisely regulated, bilaterally simultaneous, direct and rhythmic stimulus to both the masticatory and the facial muscles by short-duration and small amplitude electric pulses⁸.

Bio TENS is used to relax muscles prior to taking a clinical bite registration, it is possible to observe the effect of the ULF- TENS on the muscles by recording the electrical activity with an electromyograph (BioEMG II). The BioEMG II can show the levels of activity before and after the TENS pulsing. Many pain patients exhibit more muscle activity before pulsing and less activity after pulsing⁹.

The disadvantage of TENS is – it requires patient

co- operation, hence the procedure shouldn't be attempted in patients with a communication handicap, apprehensive patients or a patient with mental disability¹⁰. In patients with cardiac pacemakers-if the electrode placement is in the thoracic area, TENS currents can interfere with the function of pacemaker except fixed rate pacemaker. Since the patients are generally unaware of the kind of pacemaker that they use, it is advised not to use TENS in these patients. In epileptic patients- TENS "pulses" have the potential to trigger a seizure. In patients with acute pain cases/ pain of unknown aetiology, usage of TENS in undiagnosed cases may hinder in the diagnosis.

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