Electromyography (EMG) is defined as the recording and study of the fundamental electrical properties of skeletal muscle using superficial or needle electrodes with which we help in determining the muscle in contraction or not. Electromyography is abundantly used both for clinical and research purposes. In dentistry, electromyography is more commonly used for diagnosing and treating temporomandibular joint (TMJ) disorder, temporomandibular joint dysfunction, dystonia, muscle disease of head and neck, cranial nerve lesion, and also seizure disorders. Electromyography is also used in detecting diseases which are associated with damage of muscle tissue and nerve such as the one performed for the tongue muscle due to amyotrophic lateral sclerosis and facial muscle due to myasthenia gravis. Moreover, electromyography plays a significant role in diagnosing abnormalities of facial muscle during orthodontic treatment related to neuromuscular approach and facial pain associated with the use of functional appliance.

**KEYWORDS**

Electromyography, temporomandibular disorders, dentistry, bruxism, myofascial pain dysfunction syndrome.

**INTRODUCTION**

Temporomandibular disorders are defined as conditions producing abnormal, incomplete, or impaired function of the temporomandibular joint(s) and/or the muscles of mastication. Köhler and colleagues reported that approximately 50 percent of individuals in general population may have at least one sign of temporomandibular disorder, and almost up to 5 to 9 percent have clinically significant more severe temporomandibular disorder symptoms. Temporomandibular disorder may result in chronic orofacial pain that may hamper day to day activities, and may present along with other symptoms affecting the orofacial region. Temporomandibular disorder pain typically is worsened by jaw function and may be accompanied by a limitation in jaw movement, as well as by tenderness of joints, joint noises and soreness of masticatory muscles. Noninvasive, conservative treatments generally improve or relieve symptoms and are therefore advised in the initial management of temporomandibular disorders. Conservative approach in patients with temporomandibular disorders can be discouraging; however, the use of electromyography (EMG) as an adjunct to and in conjunction with other therapy interventions may be beneficial.

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**METHOD**

Electromyography has evolved from the now well-established techniques of electrocardiography and electroencephalography. The equipment required are:

1. The electrodes—which pick up the minute electrical activity.
2. An amplifying system to magnify these signals.
3. A means of recording the amplified signals.

**The electrodes:**

Commonly two types of electrode are used

(a) The surface electrode that comprises of a small metal disc attached to the skin over the muscle by a suitable conducting material such as celloidin.

(b) The needle electrode that comprises of a small hypodermic needle, containing an insulated wire.

The latter is the bipolar or coaxial type, but there are monopolar needle electrodes also available and used in conjunction with recordings from a relatively neutral part of the patient's body, e.g., the lobe of the ear. The implant electrodes, have been used in animal experiments by Turlington et al.

Surface electrodes are limited to monitor muscles situated superficially. Due to the presence of other deeper and adjacent structures, their reception is not restricted to the muscle that is to be observed. Several factors might lead to faulty readings such as the conductivity of skin or electrode placement. Surface electrodes are for this reason suitable for the studying integrated activity of the muscle mass just beneath skin. By proper symmetrical placement of these electrodes bilaterally over paired muscles, their relative activity may be studied at resting state and during various movements. This type of electromyography adequately permits the examination of some of the muscles significantly involved in mastication, deglutition, and posture of the head (typically masseter, temporalis anterior and posterior digastric, anterior sternocleidomastoid). The most important advantage of surface electromyography is that it is non-invasive. It is a painless and innocuous method for recording muscle function which may conceivably be used in the temporomandibular identification.

On the other hand needle electrodes have an area of pick-up limited to a few motor units in their immediate approximity. Insertion of a needle into the muscle itself causes trauma and gives rise to the so-called "insertion potential."
2) The amplifying system

It is usually some modification of an electroencephalograph. The number of channels differ and is a measure of the number of simultaneous recordings of which the machine is capable.

3) Recording apparatus:

Several techniques have been employed for recording. They are the cryographic inkwriter, with a synchronous controlled-speed paper feed, cathode ray oscilloscope coupled with a movie camera; and a sound amplifier recording on a magnetic tape. The inkwriter has a shortcoming of inertia and hence not accurate at frequencies over 100 cycles per second.  

Limitations of electromyography

Before considering the implications of electromyographic analysis, some of the chief limitations of this technique will be mentioned.

(1) No machine is completely free of "amplifier noise". Hence absolute electrical silence, which is synonymous with inactivity in muscle, cannot be recorded. This effect can be kept to minimum by using audio-recording, calibrating the amplifier noise as zero.

(2) Unless simultaneous recordings are made from all the muscles associated with certain activity (i.e., from the agonists, antagonists, and synergists which stabilize the part), no accurate function can be ascribed to any one muscle. It is not valid to infer an abnormality of action of a single muscle or a group based on analysis of only a few of the muscles involved in that activity.

(3) When surface electrodes are used, there is no way we can isolate the action potentials of a single group from those muscle fibres adjacent or deep, to it.

(4) When needle electrodes are used, they interfere with the normal activity of the muscle being studied.  

(5) According to Jarabak small changes in electrical activity due to slow movements to either side of the rest position, cannot be accurately monitored electromyographically.

(6) Correlation between muscular forces, i.e., tension developed, and electrical activity, is limited to certain physiological conditions. Changes in muscle length, rate of change, and muscle fatigue, which occur in the oral muscles, make such correlations impossible.

(7) Variations in the patient's performance may be beyond the operator's control.

Applications Of Electromyography In Prosthodontics

1) In Bruxism

a) Masticatory Muscle: Electromyographic Recording

The Electromyographic recording has been commonly used to measure actual sleep bruxism activity directly. The principal advantage is, that the occurrence of bruxism can be assessed without intra-oral devices, which may change normal bruxism activity.

b) Portable electromyographic Recording Device

Starting in the 1970s, sleep bruxism episodes were measured over an extended period in patients homes with the use of battery-operated Electromyographic recording devices. Its easy for subjects to use and can measure masticatory muscle activity more minutely, i.e. the number, duration and magnitude of bruxism events can be evaluated with fair accuracy. Criteria for the detection of sleep bruxism with the portable Electromyographic recording system have been suggested but their validity in a large population has not yet been confirmed. The detection power of sleep bruxism is generally considered inferior to that in a sleep laboratory because other confounding oro-facial activities (e.g. sound, coughing and talking) cannot be discriminated from sleep bruxism. Also, other sleep disorders cannot be ruled out or other physiological changes related to sleep bruxism (e.g. microarousals, tachycardia and sleep-stage shift) cannot be monitored. Also, a surface Electromyographic electrode with a built-in buffer-amplifier and a cordless type of electromyographic measurement system was developed to improve the reliability of recordings.
pain during the chewing test, and a disability score.

Immediate complete anterior guidance development \(^2\) (ICAGD) is an extensively focused coroplasty performed from the maximum intercuspal position (MIP) without mandibular manipulation to centric relation in patients with myofascial pain dysfunction syndrome as a therapeutic measure. It is a measurement driven, computer-guided occlusal adjustment procedure that shortens prolonged excursion movement occlusal surface contact frictional durations. The main objective of this therapy is to shorten the posterior discusion time to <5 s pure excursion because 0.41 was the first studied, physiologic mean discision time. It is always performed today with the T-Scan synchronized to the BioEMG III Electromyography system. The patient wears electromyography electrodes upon the masseter and temporalis muscles throughout the entire occlusal adjustment process to ensure that changes in muscle hyperactivity can be properly observed post treatment.

4jin Implant Supported Overdentures

A systematic review and meta-analysis aimed to evaluate how muscular activity, measured by electromyography (EMG), differs among edentulous patients treated with a complete denture (CD), removable implant overdentures (IO), implant-retained fixed dental prostheses (IFDP), and dentures was done. They concluded that in general, edentulous patients with complete dentures can achieve a greater degree of muscular activity after rehabilitation with Implant overdentures during clenching and chewing. During clenching, patients with implant retained fixed dental prostheses achieved higher values than those with dentures. The muscular activity increases with the hardiness of the food.

A study \(^1\) aimed to investigate the outcomes of the installation of two implant-supported overdentures until such treatment is complete. The results for Electromyography found a decrease in muscle activity during rest, the mastication of raisins, and lateral movements when the overdentures were installed.

CONCLUSION-

Electromyography is of great help in the treatment of bruxism patients by detecting uncontrolled muscle activity. It is also diagnostically useful in identifying patients with pain-related temporomandibular disorder. Further research is required to find out its other applications in prosthodontics and also to reduce few of its flaws.

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