

# Trans Electric Nerve Stimulation - A Review

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**Abstract:** Temporomandibular joint disorders (TMD) constitutes of a group of diseases or disorders that mainly affect the masticatory system, particularly the temporomandibular joint (TMJ) and related structures. Temporomandibular joint disorder patients present with a number of signs and symptoms, including pain, malocclusion, altered joint function with or without deviation, clicking and/or restricted movement. In addition, these patients may suffer from headache, tinnitus, altered vision, and other neurologic signs and symptoms might likewise go with TMD. Patients with chronic TMD have also reported to present with signs and symptoms of depression, insomnia and low self-confidence.

**Keywords:** TENS, Pain, TMJ, TENS Equipment, Segmental mechanisms

## 1. Introduction

By activating either the pain gate mechanism and/or the opioid system, TENS is a technique of electrical stimulation that provides some degree of symptomatic pain alleviation. TENS may be applied in a variety of ways, each of which corresponds to a particular physiological process.

In order to provide a painless electrical current to particular nerves, a transcutaneous electrical stimulator is used. The heat generated by the modest electrical current eases stiffness, improves movement, and alleviates pain. Also, endorphins, or natural painkillers, may be stimulated by the therapy.

Different kinds of fibers may be stimulated by varying the duration and frequency of pulses and frequencies.<sup>1</sup>

TENS is a well-known pain-relieving physical therapy method. Pain may be reduced or eliminated with TENS, which uses electrodes to provide electrical stimulation directly to the location of discomfort. In contrast to other techniques of pain management, TENS is a safe, noninvasive, effective and quick form of analgesia.

Theories on how pain is transmitted and how it is blocked by TENS are based on a number of linked concepts.

- First Gate Control Theory
- The second theory is associated with endogenous release of morphine-like substances (endorphin) after electrical stimulation.
- Third Theory of TENS is related to the automatic and involuntary contraction of muscles.

## 2. Types of TENS Therapy

TENS therapy can be divided into:

- Conventional TENS that uses low-intensity and high-frequency current
- Acupuncture-like TENS (AL-TENS) that utilizes high intensity with low frequency
- Intense TENS that involves high intensity and high-frequency therapy

### Conventional TENS

Using traditional TENS, the A-beta fibers are stimulated

only when a problem arises. Neurons of bigger size, with limited pain tolerance, are afferent neurons of this kind. The central nervous system's nociceptive neurons are inhibited by a TENS stimulation.

Increasing the pulse amplitude in TENS produces a non-painful paraesthesia below the electrodes, which provides pain relief.

### Acupuncture-Like TENS

Through the stimulation of high threshold A-delta neurons, AL-TENS leads in the activation of descending pain-inhibition pathways. As a consequence of the muscular contraction, afferent nerve fibers in the muscles are activated. On acupuncture sites or trigger points, electrodes may be placed to alleviate pain and discomfort.

### Intense TENS

TENS is used to stimulate high-threshold cutaneous A-delta fibers in order to inhibit the transmission of pain stimuli to peripheral nerves, resulting in the activation of extra segmental analgesia mechanisms. Using frequencies and intensity levels that may be tolerated by patients for short periods of time, intense TENS is able to provide relief.

Counter-irritant TENS is used in minor treatments such as wound dressing and suture removal.

Dentists use conventional TENS most commonly. Use it throughout the day, but take pauses to prevent irritating your skin. For 30 minutes at a time, AL-TENS employs low frequency and high amplitude. An extreme kind of TENS treatment employs high-frequency and high-amplitude pulsed currents, which are more difficult to tolerate and are not used often.

### Postulated Mechanisms

Segmental pain relief may be achieved using low intensity TENS paraesthesiae, which is often referred to as traditional TENS. Extrasegmental pain inhibitory mechanisms and diffuse noxious inhibitory controls through counter-irritant effects are more likely to be activated with higher intensity TENS. TENS may also inhibit afferent signals that originate from a peripheral structure. (i.e. 'busy line-effect').<sup>2</sup>

### Segmental mechanisms

When used on somatic receptive fields and following spinal cord transection, evidence from animal research demonstrates that TENS lowers central nervous system

nociceptor cell activity and sensitization. For up to two hours, TENS-induced A-delta activity reduces central nociceptor cell activity. Processes that are not part of the cellular structure Pain inhibitory pathways (A-delta) and pain facilitatory pathways (A-delta) are activated in the midbrain by TENS-induced activity in small diameter afferents (i.e. A-delta). Extensive benefits have been shown when afferents from muscles rather than skin were stimulated.<sup>2</sup>

### Peripheral mechanisms

It has been shown that TENS-induced antidromic peripheral nerve activity causes nerve impulses to collide and eliminate peripheral structural afferent signals. A-delta fibers, which are activated by TENS, are more likely to inhibit peripheral nociceptive impulses (i.e. intense TENS). Pain may be reduced by blocking afferent activity in large-diameter fibers caused by conventional TENS (i.e., traditional TENS).<sup>2</sup>

### Neurochemicals

Several neurochemicals, including opioids, serotonin and acetylcholine, are involved in TENS effects (GABA). The mu opioid and 5-HT<sub>2</sub> and 5-HT<sub>3</sub> receptors were shown to be activated by low-frequency TENS, but not high-frequency TENS. There is evidence that delta opioid receptors and aspartate and glutamate levels in the spinal cord can be reduced with high-frequency TENS, but not with low-frequency TENS.

Is there a correlation between the physiological effects reported in animal research and relevant impacts in humans?

However, there is no clear link between pulse frequency and result, as shown by experimental pain trials with pain-free volunteers, even if TENS hypoalgesia seems to be larger than sham TENS.<sup>2</sup>

### Tens Equipment

Main parts of TENS system are: [1] TENS unit. [2] Leadwires. [3] Electrodes.

#### **a) TENS unit**

It is an electric pulse generator. It has two variations:

- “Clinical” model- This is used by dentist in the clinic and is connected to the buildings electrical outlet to generate power.
- “Patient” model- This is small and portable unit which can be carried in a pocket by the patient or can be secured to the belt or clothing of the patient. It contains battery as a power source.

#### **b) Lead Wire**

These connect electrodes to TENS unit to establish electrical connection.

#### **c) Electrodes**

By means of electrodes, electric flow from TENS unit is converted into an ionic current flow in the living tissue.

Electrodes can be placed extraorally or intraorally. Extraoral electrodes are of two types:

- Carbon- impregnated silicone rubber electrodes- They

are flexible and coupled to the skin surface through the use of electrically conductive gel. They are retained in place with surgical tape.

- Tin plate or aluminum electrodes- These don't conform to the body and are coupled to the skin surface with tap water retained within cotton pad or sponge.

The intraoral electrodes are cotton roll electrodes, clamp electrodes and adhesive electrodes. Adhesive electrodes are the most widely used type nowadays. These electrodes are thin and flexible so can adapt easily to the oral mucosa

### TENS Procedure

In TENS, precise electrode placement is a time-consuming yet critical step. The electrodes must always be put on healthy, undamaged skin that has not been changed in any manner. For broad discomfort, four-electrode units may be necessary.

In TENS, electrodes may be either extraoral or intraoral, depending on the patient's preference.

Silicone rubber electrodes loaded with carbon and tin plate or aluminum electrodes are the two most common extraoral electrode options.

The components of intraoral electrodes are a cotton roll, a clamp, and adhesive electrodes.

A variety of stimulation frequencies, intensities, and pulse lengths are used in TENS treatment. The most generally used therapy settings are a 90 Hz frequency and a 30-minute treatment period, used three times a day.

The number of therapy sessions varies greatly depending on the therapeutic need.

### **Mode of Action**

TENS uses antidromic stimulation of peripheral nerves to generate nerve impulses. Afferent impulses from the periphery are suppressed when they clash with these afferent impulses from the central structures.

Extensive TENS treatment blocks the most painful peripheral impulses when A- delta fibers are activated.

This results in a reduction in the activity of large diameter afferent nerve fibers, which play a role in pain alleviation (i.e., conventional TENS).

A variety of neurochemicals, including opioids, serotonin, and acetylcholine, are responsible for the therapeutic benefits of TENS treatment

Low-frequency TENS treatment uses mu opioid and hydroxytryptamine receptors to treat pain. The spinal cord's aspartate and glutamate levels are reduced by using high-frequency TENS treatment, which targets the delta opioid receptors.<sup>6</sup>

## Applications of TENS Therapy in Dentistry

### Temporomandibular Disorders

The myoelectric activity of the mandibular elevator muscles is higher in patients with TMD compared to healthy individuals. TENS treatment reduces pain and myoelectric activity in the muscles, both of which are beneficial.<sup>9</sup>

In order to boost blood and oxygen flow, minimize edema of the interstitial tissues, and accelerate the clearance of accumulated toxins, TENS activates motor neurons. In the end, all of these occurrences will lead to less muscular soreness and exhaustion.

### Dental Treatment in Pediatric Patients

Negative conduct by children at dentist offices is the most prevalent observation, since they are afraid of needles. TENS may be used to reduce discomfort during operations such as extractions and root canals in pediatric dentistry patients. As a result of reducing childhood "trypanophobia" by TENS treatment, patients exhibit less anxious behaviors.

### Postherpetic Neuralgia

Many of the myelinated nerve fibers in postherpetic neuralgia have been damaged. As a result, the natural suppression of pain sensation is gone. Postherpetic neuralgia is characterized by severe pain and hyperalgesia as a result of this process. By stimulating big fibers, TENS aims to counteract the inhibitory effects of small ones<sup>8,9</sup>.

### Advantages

- A safe, non-invasive anesthetic that may be administered to individuals who are afraid of needles can be obtained using this method.
- When the TENS device is switched off, there is no postoperative anesthesia as there is with local anaesthetic.
- To control their discomfort, patients may self-administer TENS therapy and gradually increase the dose. As a consequence, the patients have a favourable reaction.

## 3. Contraindications

- 1) Apprehensive patients- It is not recommended to use TENS on patients who have a communicative or mental problem since the technique relies on active participation from the patient
- 2) Patients with cardiac pacemakers- TENS currents may interfere with pacemaker performance if the electrodes are placed in the thoracic region, except for fixed rate pacemakers. The use of TENS is not recommended in individuals with pacemakers who may not be aware of the kind of device they have.
- 3) Patients with cerebrovascular problems- Because TENS promotes peripheral blood flow, it should not be used on individuals with a history of aneurysm, stroke, or transitory ischaemia.
- 4) Epileptic patients- There is a chance that TENS "pulses" might cause a seizure.
- 5) Pregnant patients- As a result, there are no particular

negative effects. However, since the FDA has not approved its use, it is considered unacceptable.

- 6) Acute pain cases/pain of unknown etiology- Undiagnosed instances may be hindered by the use of TENS<sup>9</sup>.

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