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## Transcutaneous Electrical Nerve Stimulation (TENS) In Dentistry: A Comprehensive Review

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**ABSTRACT:**

Transcutaneous electrical nerve stimulation (TENS) therapy is a technique commonly used in pain management and rehabilitation. It works through activation of descending inhibitory neurons of the CNS. While TENS therapy is not exclusive to dentistry, it can be utilized as an adjunctive treatment option in certain dental scenarios, particularly for conditions involving muscle pain, temporomandibular joint (TMJ) disorders, and orofacial pain.<sup>1</sup> It has shown great results in inducing salivary secretion in xerostomia patients and has been used as a local anesthetic agent in childrens in pediatricsubjets. It has also been studied for its role in increasing salivary secretion in subjects with xerostomia and as a local anesthetic agent in pediatric dentistry. Its wide applications in the orofacial region make it an important treatment modality .The purpose of the present review was to describe the general principles and its applications in dentistry along with its indications, advantages, and disadvantages.<sup>2,3</sup>

**Keywords:**Tens, Pain, Tmd, Dentistry.

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**1. Introduction**

Transcutaneous Electrical Nerve Stimulation (TENS) therapy is a non-invasive medical technique used to manage and alleviate pain. It involves the application of low-voltage electrical currents to the skin's surface using electrode pads. TENS therapy aims to modulate pain perception by stimulating sensory nerves, which can lead to the release of endorphins and other natural pain-Rrrelieving substances within the body.The concept behind TENS therapy is based on the gate control theory of pain, which suggests that non-painful input can "close the gate" to painful input, thereby reducing the sensation of pain. By delivering controlled electrical impulses, TENS machines can help in diverting or blocking pain signals from reaching the brain, effectively providing temporary relief from various types of pain.TENS units typically offer adjustable settings for intensity, frequency, and pulse duration, allowing users to customize their treatment according to their comfort levels and the type of pain they're experiencing. TENS therapy is often utilized for conditions like chronic

pain, musculoskeletal pain, postoperative pain, arthritis, and certain types of neuropathy.<sup>2,3,4,10</sup>

### **History of TENS**

The history of Transcutaneous Electrical Nerve Stimulation (TENS) therapy dates back several

decades and has evolved through a series of discoveries and developments. Here's a brief overview:

The idea of using electricity to reduce pain is not a new concept. Scribonius Largus recorded the use of an electric eel for treatment of headache and gout in 46 A.D. The use of electrical currents for medical purposes has roots in ancient civilizations, where electric fish were applied to painful areas to provide relief. However, the systematic use of electricity in medicine began in the 18th century.<sup>5</sup>

**Gate Control Theory:** The theoretical basis for TENS therapy emerged in the mid-20th century. In 1965, Ronald Melzack and Patrick Wall proposed the "gate control theory of pain," which suggested that non-painful stimuli could block or modulate the perception of pain signals at the spinal cord level. This theory laid the groundwork for understanding how electrical stimulation might influence pain perception.<sup>5,6</sup>

The first TENS devices were developed in the 1970s. They were large and cumbersome machines that required medical supervision. These early devices primarily used high-frequency electrical stimulation for pain relief.<sup>5,6</sup>

In the 1970s and 1980s, researchers began to explore the idea that TENS therapy stimulated the release of endorphins—natural pain-relieving chemicals—in the body. This helped explain the mechanism by which TENS provided pain relief.<sup>5,6</sup>

As technology advanced, TENS devices became more portable and user-friendly. Portable TENS units started becoming available in the 1980s, allowing patients to use them at home.

### **Classification of TENS Clinically**

TENS is applied at varying frequencies, intensities, and pulse durations of stimulation. Depending upon frequency of stimulation, TENS is broadly classified into 2 categories<sup>5</sup>:

- 1 High frequency TENS [ $>50\text{Hz}$ ].- operates via the gates theory producing only short term analgesia,
- 2.Low frequency TENS ( $<10\text{ Hz}$ ) -operates through release of endogenous opioids which causes a more systemic and long-term response
3. Burst (B) – Provides low frequency bursts of pulses
4. Modulated (M) – Provides a variation in pulse width, frequency and intensity to prevent accommodation

### **Tens Equipment**

A transcutaneous electrical nerve stimulation (TENS) machine is a device that uses electrical currents to provide pain relief by stimulating the nerves through the skin. It's often used for various types of pain management. Here are the main parts of a typical TENS machine:

**Control Unit:** The main component of the TENS machine is the control unit. It houses the electronics and controls for adjusting the settings, such as intensity, frequency, and mode. The control unit may have buttons, a screen, or a digital interface to allow users to make adjustments.

**Electrode Pads:** Electrode pads are the components that attach to the skin and deliver the electrical stimulation. These pads are connected to the control unit via wires. . Electrodes can be placed extraorally or intraorally. Extraoral electrodes are of two types:

[1] 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.

[2] 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 and have adhesive backing to adhere to the skin securely. Electrode pads come in various shapes and sizes to accommodate different body parts and treatment areas.

Wires or Leads: Wires or leads connect the electrode pads to the control unit. These wires transmit the electrical impulses from the control unit to the electrode pads, which then deliver the stimulation to the skin and nerves.

Battery or Power Source: TENS machines are usually powered by batteries. The control unit will have a compartment for inserting and replacing the batteries. Some advanced models might have rechargeable batteries or the option to connect to a power outlet.

### **Advantages of TENS therapy**

1. Non-Invasive and Drug-Free -can be used to achieve anesthesia in needle-phobic patients
2. Localized Treatment: TENS therapy can be applied directly to the area of pain, allowing for targeted treatment.
3. Many TENS units are designed for home use
4. Minimal Side Effects: When used correctly and as directed by a healthcare professional, TENS therapy typically has minimal side effects.
5. TENS therapy is generally well-tolerated by most individuals.

### **Dis-Advantages of TENS therapy**

TENS therapy can mask pain, which might make it difficult to identify or address the underlying cause of the pain. Relying solely on TENS for pain management without addressing the root cause could potentially delay appropriate medical treatment.

Prolonged or excessive use of TENS electrodes can lead to skin irritation, redness, itching, or even mild burns at the electrode sites. Using the wrong settings or leaving electrodes on for too long can increase the risk of skin problems.

Contraindications: TENS therapy is generally safe, but there are certain situations where it should be avoided, such as during pregnancy (unless under medical supervision), over areas of skin with open wounds or infections, or for individuals with certain medical conditions like pacemakers or certain heart conditions & Patients with cerebrovascular problems. Patients with a history of aneurysm, stroke and transient ischaemia shouldn't be treated using TENS, as it stimulates peripheral blood flow which can be fatal in such cases

High-quality TENS devices can be expensive, and not everyone may have easy access to these devices. In some cases, insurance coverage might not be available for TENS therapy.

### **TENS Therapy in dentistry**

Dental Anesthesia in Pediatric Patients: The most frequently seen negative behavior in pediatric patients is dread of syringes or electrodes. TENS treatment has a good impact on pediatric patients' behavior, which lowers anxiety levels by removing their "fear of needles" According to studies, TENS is preferred by youngsters over local anesthetics. TENS helps to accomplish pain control while performing various treatments including extraction and endodontic procedures.<sup>6</sup>

Trigeminal Neuralgia: type of chronic pain disorder that is sudden, severe facial pain. It affects the trigeminal nerve, or fifth cranial nerve, which provides feeling and nerve signaling to many parts of the head and face. Numerous therapeutic options have been tested, including medication, alcohol injections, peripheral neurectomy, rhizotomy, and micro-vascular decompression. TENS has been used successfully to alleviate chronic pain of trigeminal neuralgia.<sup>7</sup>

Temporomandibular Joint Disorder: TMD has been successfully treated by TENS, either alone or in conjunction with other methods.

Myofascial pain dysfunction syndrome: A persistent pre-auricular ache that may be radiating and diffuse in nature is a hallmark of the myofascial pain dysfunction syndrome (MPDS). It typically includes clicking and uncomfortable or limited mouth opening. Considering that the disorder has a complex origin, it is challenging to pinpoint the starting point. By activating big peripheral A-delta fibers with the TENS unit, which closes the “gate” and blocks pain input from small C-fibers, active TENS therapy is applied to patients with MPDS to relieve pain. TENS is an effective, non-invasive treatment that can be used as an adjunct to traditional therapy for patients with MPDS. The findings of our study are promising, and TENS therapy has demonstrated better outcomes in the care of MPDS patients when compared to placebo TENS therapy. TENS stimulates motor nerves leading to periodic muscle contractions that, in turn, cause increased perfusion and oxygen supply, decreased edema of the interstitial tissues, and increased clearance of accumulated toxins. All these events will lead to decreased pain and fatigue of muscles<sup>8</sup>

Xerostomia -Application of TENS increases the salivary flow rate in healthy individuals as well as in xerostomic patients. Hargitai et al. in 2005 found increased salivary flow in two-thirds of healthy adult subjects after application of TENS on the skin overlying the parotid glands. Their results also suggested that for TENS to be effective, baseline saliva flow should be present.<sup>9,10</sup>

Dental treatment in adult patients- TENS has been successfully used as analgesia during various procedures like rubber dam placement, cavity preparation, pulp capping & endodontic procedures, prosthetic tooth preparations, oral prophylaxis as well as extractions. It is also used to reduce the discomfort from injection of local anesthesia and to alleviate periodontal pain associated with orthodontic separation.

## 2. Conclusion

Transcutaneous Electrical Nerve Stimulation (TENS) therapy is a non-invasive and generally safe technique that involves the use of low-voltage electrical currents to provide pain relief. While TENS therapy offers several potential benefits, it is important to consider both its advantages and disadvantages before incorporating it into a pain management or treatment plan.

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### Conflicts of interest

There are no conflicts of interest.

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