

## Exploring the efficacy of TENS in Prosthodontics –A Narrative Review

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**Abstract:** Transcutaneous Electrical Nerve Stimulation (TENS) is a therapeutic technique that involves the application of low-voltage electrical currents to the skin surface, typically using electrode pads placed on specific areas of the body. TENS has garnered significant attention in prosthodontics due to its potential to manage orofacial pain and improve treatment outcomes.

In Prosthodontics, TENS therapy is useful for patients undergoing various prosthodontic treatments e.g. to control pain signals, providing relief, such as dental implant placement, temporomandibular joint (TMJ) therapy, or fabrication of dental prostheses. Furthermore, TENS facilitates neuromuscular relaxation and rehabilitation, which is crucial for achieving optimal outcomes in prosthodontic rehabilitation. By harnessing the benefits of TENS technology, prosthodontists can enhance treatment efficacy, improve patient satisfaction, and ultimately, elevate the standard of care in prosthodontic practice. Thus, TENS offers promising benefits in Prosthodontics. However, there are certain limitations such as Skill and training requirements for proper application, cost and accessibility barriers, and risk of overuse or dependency.

This table clinic presentation aims to explain the different applications and effectiveness of TENS in prosthodontic practice.

**KeyWords:** Transcutaneous Electrical Nerve Stimulation, Pain, Temporomandibular disorders

**Introduction:** Medical and paramedical practitioners frequently employ transcutaneous electric nerve stimulation (TENS), a non-pharmacological technique, to treat both acute and chronic pain in a range of diseases. It is a cutting-edge method used in the field of dentistry. It causes muscular stimulation in a non-invasive way by using a low voltage electrical current that is carefully controlled.<sup>(1)</sup>

When Jenkelson proposed using TENS instead of traditional border molding in prosthodontics clinical practice in 1971, the usage of TENS in this field increased. Numerous research reported in the literature have demonstrated that TENS treatment induced a change in the physiological and biochemical state of the muscles, resulting in

the relaxation of such muscles.<sup>(2)</sup> TENS therapy is helpful for patients receiving various prosthodontic procedures, such as dental implant placement, temporomandibular joint (TMJ) therapy, or the creation of dental prostheses, as it can regulate pain signals and provide relief. TENS also promotes neuromuscular relaxation and rehabilitation, both of which are essential for prosthodontic rehabilitation to be completed as effectively as possible.

Hence, the purpose of this article is to review its applications in prosthodontics so as to raise awareness among prosthodontist regarding its dental applications.

Considering this concept, table clinic was presented in 26th IPS PG Convention Chennai.

**Description:** In this table clinic, we have made three models that demonstrate the application of TENS in prosthodontics.(Fig-1)

**Model 1- A border molding technique for individuals wearing complete dentures:** Dental stone was used to create a facial moulage, which was then painted with acrylic paints. It shown that the electrodes were placed in the posterior region of triangle and the pre-auricular region on one side.

Cardboard was used to construct a Tens unit, which included instructions the parts of it and the frequently required for border molding in complete denture patients.

A case report provided by Gowda et al. was described.<sup>(2)</sup>

**Model 2- Pain in certain temporomandibular disorders:** Three models depicting various painful TMDS symptoms were created.

It explained by the mechanism of action of pain in gate control theory and the endogenous opioid theory are utilized to explain how TENS is used to relieve pain in such situations.

**Model 3- In patients with Xerostomia:** We depicted the parotid gland, on which the TENS electrodes were put directly, on the opposite side of the same facial moulage and the mechanism of action that explains why TENS is used to stimulate saliva in xerostomia patients was explained.

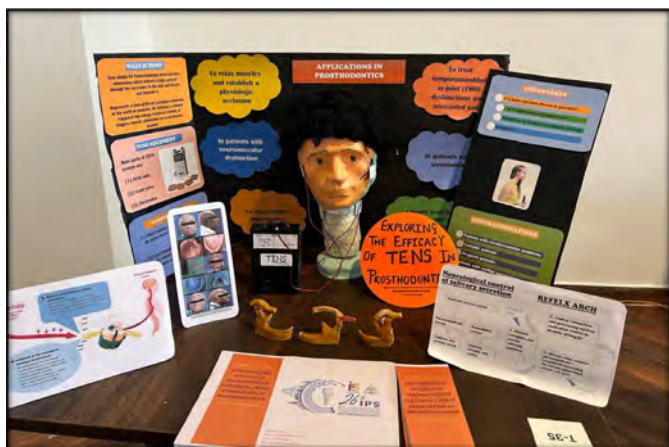


Fig-1 Table Clinic showing applications of TENS in prosthodontics which was presented in 26th PG Convention Chennai

Bulbule et al in 2013 used TENS for rehabilitation of completely edentulous patients to record functional borders with cheek plumpers and found that TENS is an alternative and good approach for a crucial step of border molding.<sup>(3)</sup>

Kasat et al in 2014 reviewed Transcutaneous electric nerve stimulation (TENS) in dentistry and concluded that TENS has wide number of applications in dentistry and Its analgesic and non-analgesic physiologic effect can be used in the management of a variety of conditions affecting maxillofacial region.<sup>(1)</sup>

Singh et al in 2014 evaluated the effect of TENS therapy and Placebo drug therapy in the management of TMJ pain disorder and concluded that the effect of TENS therapy has proved to be better than the effect of placebo drug therapy in reduction of intensity of pain, tenderness of the muscles, and opening of the mouth in TMJ pain disorders.<sup>(4)</sup>

Rela et al in 2018 evaluated the effect of transcutaneous electric nerve stimulation (TENS) as pain management in TMD patients and found that TENS therapy as an adjuvant modality in controlling pain associated with TMD's. Pain reduction and improvement in the mouth opening are the main goal in the treatment of TMDs,encouraging results were found in this study.<sup>(5)</sup>

Bahri et al in 2021 descibed a case report in which Ultra-low-frequency Transcutaneous Electric Nerve Stimulation was used for Recording Functional Impression and Neuromuscular Relation in a Completely Edentulous Patient and found that Ultra-low-frequency TENS can be used as an acceptable clinical modality to obtain a satisfactory outcome in recording border molding to achieve stability in complete denture prosthesis. Its ability to cause controlled excitation of muscles can be used to record physiological extension of borders and to guide condyle to a neuromuscular-oriented centric relation.<sup>(6)</sup>

Chandra et al in 2022 evaluated the efficacy of transcutaneous electrical nerve stimulation (TENS) on salivary flow rate in patients with xerostomia and concluded that TENS therapy was highly effective in stimulating whole salivary flow. The encouraging results of this study indicate that TENS has the potential to increase salivary flow rate and can be an important alternative in the xerostomia treatment.<sup>(7)</sup>

### Discussion:

**Classification of TENS:** TENS is used in clinical settings with different stimulation frequencies, levels, and pulse lengths. Based on the frequency of stimulation, TENS is often divided into two groups:

[1] TENS with high frequency (>50Hz).

[2] TENS at low frequencies (<10 Hz).

Low frequency TENS releases endogenous opioids, which results in a more systemic and prolonged response, while high frequency TENS uses the gates hypothesis to produce just short-term analgesia.

**Parts of Tens Equipment:** Main parts of TENS system are: 1) TENS unit. 2) Lead wires. 3) Electrodes

The TENS unit generates electric pulses. There are two versions of it:

[1] “Clinical” model: This is utilized by dentists in clinics and generates electricity when linked to the building’s electrical socket.

[2] “Patient” model: This is a compact, lightweight device that the patient can carry in their pocket or fasten to their belt or clothes. It has a battery within it for electricity.

Lead wires are used to create an electrical connection between the electrodes and the TENS unit.

Electrodes: The electric flow from the TENS unit is transformed into an ionic current flow in the live tissue through the use of electrodes. It is possible to insert extraoral or intraoral electrodes.

There are two kinds of extraoral electrodes:

1. Silicone rubber electrodes impregnated with carbon: these electrodes are flexible and connected to the skin’s surface by means of an electrically conductive gel. Suture tape is used to hold them in place.
2. Tin plate or aluminum electrodes: These are attached to the skin’s surface using a cotton pad or sponge that contains tap water and do not mold to the shape of the body.

Three types of electrodes are used intraorally: adhesive, clamp, and cotton roll electrodes. These days, adhesive electrodes are the most popular kind. Due to their thinness and flexibility, these electrodes can easily conform to the mouth mucosa.

### Mechanism of action of Pain Management:

Analgesic effect of TENS is based on two main theories- Gate control theory of pain and endogenous opioid theory.

**Gate control theory of pain:** The most widely accepted hypothesis to describe how TENS works is the gate control theory of pain, which was put forth by Melzack and Wall in 1965. They proposed that the substantia gelatinosa, which is located in the spinal cord’s dorsal horn, serves as a gate control mechanism that modifies peripheral fiber afferent patterns before they have an impact on the spinal cord’s initial central transmission [T] cells. Pain is transmitted by small, unmyelinated “C” fibers, whose activity maintains the gate largely open. The activity of big myelinated A fibers closes the gate, preventing impulses from reaching T cells, and exerts presynaptic inhibition on input from C fibers. By increasing big fiber input and lowering tiny fiber input, pain can be controlled.

**The endogenous opioid theory:** In 1969, Reynolds showed that electrical stimulation of periaqueductal gray region of the midbrain produces analgesia equivalent to that induced by morphine. Subsequently, this led to the discovery of several

morphine like chemicals called endorphins which exist at various levels of the pain control pathway. Thus, alternative explanation for the mechanism of action of TENS is that it stimulates the release of endogenous opioids in the spinal cord which could result from activation of local circuits within the spinal cord or from activation of descending pain-inhibitory pathways.

### Applications in Prosthodontics:

- To address pain related to temporomandibular joint dysfunctions (TMD).
- In those who suffer from neuromuscular dysfunction.
- To create a physiologic occlusion and relax muscles.
- To register an occlusal bite.
- To obtain impressions for dentures.
- To preserve or extend mandibular range of motion.
- To improve local blood circulation.
- In those who have xerostomia.
- In the maxillofacial region, chronic pain.

### Advantages:

1. It can be used to induce anesthesia in patients who have a phobia of needles and is safe and non-invasive.
2. There is no postoperative anesthesia following the turning off of the TENS device, in contrast to local anesthesia.
3. In order to control their excruciating condition, patients might learn to titrate dosages for TENS treatment and administer it on their own. Patients

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positively accept this as a result.

### Contraindications:

1. Uneasy patients: Because TENS involves patient cooperation, it shouldn't be attempted on individuals who have mental or communication impairments.
2. Patients with cardiac pacemakers: TENS currents, with the exception of fixed rate pacemakers, can interfere with the operation of the device if the electrode is placed in the thoracic region. It is recommended not to use TENS on individuals who have pacemakers because they typically don't know what kind of device they have.
3. Patients with cerebrovascular issues: TENS should not be used to treat patients who have experienced a transitory ischemia, aneurysm, or stroke because it might be lethal in these situations due to its stimulation of peripheral blood flow.
4. Individuals with epilepsy: TENS "pulses" may cause a seizure.
5. Patients who are pregnant: There are no particular adverse effects. However, using it is discouraged because the FDA has not approved it.
6. Acute pain situations and pain with no known cause: using TENS in cases that remain unexplained may make the diagnosis more difficult.

**Conclusion:** TENS has garnered significant attention in prosthodontics due to its various applications but the discipline of prosthodontics lacks knowledge and awareness about the applications of TENS, hence addressing the knowledge gap in this field is imperative.

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