

Review Article

Application of TENS in Dentistry: A Review

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ABSTRACT:

Transcutaneous Electrical Nerve Stimulation (TENS) is emerging as a valuable tool in dentistry for pain management and muscle relaxation. By delivering low voltage electrical currents through the skin, TENS reduces acute and chronic pain without medication. Its application ranges from alleviating temporomandibular joint disorders and enhancing orthodontic treatments to improving postoperative recovery and reducing anxiety. TENS is non-invasive and customizable, allowing adjustments in frequency and intensity for personalized care. Its growing acceptance in dental practices underscores its potential in improving patient comfort and reducing reliance on pharmaceuticals, highlighting its significance as a complementary modality in modern dental care.

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INTRODUCTION

Pain has been an enduring challenge throughout human history, influencing many facets of life, including the field of dental care. Managing dental pain has traditionally involved both pharmacological and non-pharmacological approaches. The predominant pharmacological method in dentistry involves employing local anesthesia to numb the area during procedures, coupled with analgesics to mitigate discomfort after the procedure. Despite their effectiveness, these techniques have downsides; notably, the common fear of needles and syringes can cause considerable distress to patients, deterring them from seeking necessary dental care.¹

A promising alternative approach, existing outside the realm of pharmaceuticals, is transcutaneous electrical nerve stimulation. Recognized and approved by the U.S. Food and Drug Administration in 1972, TENS is categorized as a Class II medical device. The essence of TENS therapy lies in its ability to deliver pain relief via a pulsed electrical current, generated either from an alternating current (AC) power source or a standard 9V battery. This carefully controlled electrical current is transmitted through electrodes positioned on the skin's surface, targeting superficial nerves to achieve localized pain relief.^{2,3}

TENS has gained extensive recognition and use among healthcare professionals for effectively managing varying degrees of pain, encompassing both acute and chronic conditions. Despite its widespread applications across general healthcare, the potential of TENS is not fully tapped within the dentistry sector. The device's ability to relieve pain without pharmaceuticals is particularly significant; however, its deployment in dental settings remains limited and underexploited.⁴

To realize the full benefits of TENS in dentistry, it is crucial to elevate the awareness and understanding of its capabilities among dental professionals. Integrating TENS into dental pain management protocols could provide a valuable option for patients, especially those apprehensive about traditional anesthetic methods. Promoting knowledge and acceptance of TENS can revolutionize pain management in dental care, offering patients a comfortable, needle-free experience that aligns with modern patient-centered care approaches.

In conclusion, while local anesthetics and analgesics continue to dominate as the primary methods for dental pain management, TENS represents an underutilized yet potent ally. Elevating its role in dentistry could not only enhance patient care but also

redefine approaches to pain management without the need for pharmaceuticals.

Mechanism of action: The mechanism of action of Transcutaneous Electrical Nerve Stimulation involves several physiological processes that result in pain relief. Here's a brief overview of how it works:^{1,3,6,7}

Gate Control Theory: TENS is primarily linked to the gate control theory of pain. According to this theory, the spinal cord has a neurological "gate" that can be opened or closed to allow or prevent pain signals from passing to the brain. TENS stimulates large sensory nerve fibers, which can "close the gate" by blocking the transmission of pain messages through the smaller nerve fibers to the brain. This reduces the perception of pain.

Release of Endorphins: TENS can stimulate the release of endorphins, the body's natural painkillers. These are neurotransmitters that interact with the receptors in the brain to reduce the perception of pain and can elicit a sense of well-being.

Increased Blood Flow: The electrical impulses from TENS can increase blood flow to the targeted area, promoting healing and reducing inflammation. This is particularly beneficial in areas that may be experiencing low-level chronic pain due to restricted blood flow.

Neurotransmitter Modulation: TENS may modulate the release and uptake of neurotransmitters that are involved in the sensation and perception of pain, such as serotonin and substance P. This modulation can result in decreased transmission of pain signals.

Peripheral Blockage: At the site of placement, TENS can cause a temporary interruption in the transmission of pain signals by altering the conductance and function of peripheral nerves.

These mechanisms collectively contribute to the effectiveness of TENS as a non-pharmacological pain management tool. The benefits of TENS therapy include its non-invasive nature, the reduction of reliance on pain medications, and the ability to provide targeted pain relief, which makes it an attractive option for both acute and chronic pain management.

Parts of Machine: The TENS machine is composed of several key parts, each contributing to its function of delivering therapeutic electrical pulses for pain relief.

TENS Unit: The core of the TENS machine is the TENS unit itself, responsible for generating the electrical pulses. There are two main models of the TENS unit:^{1,7}

- 1. Clinical Model:** This larger variant is primarily used by healthcare professionals, such as dentists, within clinical settings. It operates by connecting to a building's electrical outlet, ensuring a constant power supply for consistent functionality during treatment sessions.
- 2. Patient Model:** Designed for personal and ambulatory use, this compact, portable version allows users to move around freely. It can be conveniently carried in a pocket, attached to a belt, or integrated into clothing. This model runs on a battery, making it accessible for home and travel usage.

Lead Wires: These function as the connection between the TENS unit and the electrodes. The wires facilitate the transmission of electrical signals, ensuring that the current reaches the electrodes effectively for therapeutic use.

Electrodes: Electrodes serve a crucial role by converting the electrical flow from the TENS unit into an ionic current flow suitable for application on living tissue. They are used both externally and internally, depending on the treatment requirements:

- 1. Flexible Electrodes:** Made from silicone rubber impregnated with carbon, these electrodes are highly adaptable and work with an electrically conductive gel. They are typically secured to the skin with surgical tape to ensure they remain in place.
- 2. Rigid Electrodes:** Constructed from materials like tin plate or aluminum, these do not conform to the body's shape. They are attached to the skin with cotton pads or sponges that are soaked in tap water to facilitate conductivity.

Each component of the TENS machine plays a vital role in ensuring that therapeutic electrical stimulation is delivered safely and effectively to the desired area for pain relief.

CLINICAL APPLICATION OF TENS⁶⁻⁹

Alternative Dental Anesthesia in Pediatric Patients: One common challenge with pediatric dental patients is their fear of needles or electrodes. Transcutaneous Electrical Nerve Stimulation therapy positively influences pediatric behavior by alleviating this "fear of needles" and reducing anxiety levels. Children often prefer TENS over local anesthetics. Recent studies have shown TENS to be just as effective as 2% lignocaine during minor pediatric dental procedures.

Temporomandibular Joint Disorder: Temporomandibular joint disorders (TMDs) are a group of conditions affecting the masticatory system, including the temporomandibular joint and the masticatory muscles. These disorders have various causes and treatments, with TENS identified as an effective option. TENS can successfully treat TMDs

alone or combined with other methods. Researchers found TENS to be more effective in reducing electromyographic activity in the masseter muscles, although both TENS and electromyographic biofeedback led to muscle relaxation in bruxism patients.

Trigeminal Neuralgia: This condition affects the trigeminal nerves that supply the teeth, jaw, and face. Although the exact cause of trigeminal neuralgia is often unknown, several treatment options, including medication, alcohol injections, peripheral neurectomy, rhizotomy, and microvascular decompression, have been explored. TENS offers a new and promising treatment avenue for these patients.

Myofascial Pain Dysfunction Syndrome: Characterized by a persistent pre-auricular ache that can be diffuse and radiating, myofascial pain dysfunction syndrome (MPDS) often involves additional symptoms such as clicking and discomfort in the jaw area. TENS can offer significant relief by helping to reduce muscle tension and pain. Additionally, TENS has applications in managing back pain, migraines, and arthritis by promoting endorphin release and improving local blood flow. Whether addressing chronic pain conditions, easing labor pains, or enhancing post-surgical recovery, TENS is recognized for its versatility and ability to provide non-invasive relief from various pain-related conditions.

Anxiety Reduction for Procedures: By reducing overall anxiety and creating a more relaxed environment, TENS helps patients feel at ease even during more routine dental visits.

Post-Treatment Recovery: TENS is also utilized in post-operative scenarios to manage pain and swelling, enhancing the recovery process after procedures such as tooth extractions or oral surgeries.

In summary, TENS is becoming an invaluable tool in dentistry due to its versatility and effectiveness in managing pain and anxiety, making it a preferred choice for both practitioners and patients seeking non-invasive treatment options.

CONTRAINDICATION OF TENS¹⁻³

Apprehensive Patients: TENS requires patient cooperation, so it shouldn't be used on individuals with communication impairments or mental disabilities.

Patients with Cardiac Pacemakers: When electrodes are placed in the thoracic area, TENS currents can interfere with pacemakers, except for fixed-rate pacemakers. Patients often don't know what type they have, so it's advised not to use TENS in these cases.

Patients with Cerebrovascular Issues: Those with a history of aneurysm, stroke, or transient ischemia should avoid TENS, as it stimulates peripheral blood flow, potentially causing harm.

Epileptic Patients: The pulses from TENS can potentially trigger seizures.

Pregnant Patients: While no specific side effects are known, TENS use is discouraged in pregnancy due to lack of FDA approval.

Acute Pain Cases or Pain of Unknown Origin: Using TENS without a clear diagnosis can complicate the diagnostic process.

ADVANTAGES OF TENS IN DENTISTRY¹⁻³

Pain Relief: TENS can effectively reduce dental pain by stimulating nerves and blocking pain signals to the brain.

Non-Invasive: Unlike medication, TENS is a non-invasive method that provides pain relief without drugs.

Muscle Relaxation: TENS can help relax jaw muscles, improving comfort for patients with TMJ disorders or bruxism.

Ease of Use: Patients can use TENS units at home with minimal training, making it a convenient option for ongoing pain management.

Minimal Side Effects: Generally considered safe, TENS units carry few side effects compared to pharmacological treatments.

LIMITATIONS OF TENS IN DENTISTRY¹⁻³

Limited Pain Relief: TENS may not be effective for all types of dental pain, particularly severe or chronic conditions.

Patient Compliance: Success with TENS requires patient cooperation and proper use, which may be challenging for some.

Contraindications: Not suitable for patients with certain conditions such as epilepsy, pacemakers, or cerebrovascular issues.

No Curative Benefit: TENS addresses symptoms rather than underlying dental problems, requiring additional dental intervention.

Variable Efficacy: The effectiveness of TENS can vary greatly between individuals and may require adjustments in settings for optimal use. These factors underline TENS's role as a supplementary tool in dental pain management, rather than a standalone solution.

CONCLUSION

TENS should be considered a primary, safe, and uncomplicated treatment option for various pain conditions, including trigeminal neuralgia, temporomandibular joint disorder, and myofascial pain dysfunction syndrome. This is particularly significant in rural areas where access to specialized procedural expertise for complex therapeutic management is limited. In such regions, TENS provides an accessible alternative for pain management, offering relief when other resources are unavailable.

Moreover, TENS is highly beneficial for patients who have experienced adverse reactions to medications, providing a non-pharmacological approach with minimal side effects. It is also suitable for those who are reluctant or refuse to take medication due to potential side effects or specific health concerns.

Furthermore, TENS represents a cost-effective solution, especially for individuals unable to afford expensive or invasive surgical interventions. By presenting a non-invasive, drug-free pain management option, TENS empowers patients with control over their pain, leading to improved quality of life without financial strain. Thus, in scenarios where traditional medical approaches are not feasible or desirable, TENS stands out as a practical and effective first-line treatment.

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