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TRANSCUTANEOUS ELECTRICAL NERVE STIMULATION (TENS) IN PAIN MANAGEMENT -AN OVERVIEW

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ABSTRACT:

Medical and paramedical professionals frequently employ transcutaneous electric nerve stimulation (TENS), a non-pharmacological technique, to manage pain and to give them insight into the clinical research evidence supporting the use of TENS as an analgesic and non-analgesic in both paediatric and adult patients with dental-related conditions. In an effort to increase knowledge, a brief discussion of the history of therapeutic electricity, the mechanism of action of TENS, the components of tens equipment, types, administration ways, benefits, and contraindications among dentists is also attempted. It is utilised in dentistry because of its dental applications [1]

Keywords: Transcutaneous Electrical nerve stimulation, Pain, Orofacial pain [2]

INTRODUCTION:

Transcutaneous Electrical Nerve Stimulation (TENS) is a noninvasive analgesic treatment used to treat nociceptive, neuropathic, or musculoskeletal pain [3].Non- invasive treatment methods called transcutaneous electrical nerve stimulation use a regulated electrical current to provide precise pain relief and encourage neuromuscular adaptation. These gad gets are usually batterypowered, portable, and can be used by patients on their own or with a healthcare professional's supervision [4]. TENS devices often offer a broad range of adjustment, enabling the user to control the frequency, width, and intensity of their pulses. TENS is widely used by medical experts to treat both acute and chronic pain. TENS is not commonly used in dentistry, despite its potential advantages. Therefore, the purpose of this article is to expand the dental community's understanding of its dental applications by discussing its use in dentistry [3]

HISTORY:

The Concept of pain Relief by using electricity is a very old technique and not something new. It was 1st used During ancient times, Egyptians in 2,500 BC used to apply electrogenic fish to packs of body that were painful The Name TENS was discovered in the 18th century the discovery of Electrostatics [5].By the late 19th century, electrotherapy had become less common due to the growing use of pharmaceutical therapies, which was aided by electrostatic generators in the 18th century [6].After Melzack and Wall Spain's "A New theory" was published in 1965, interest in the usage of electricity was rekindled. They proposed that in order to prevent the central transmission of harmful information, electrical stimuli may be employed to activate large diameter peripheral afferents. clinical observations. It has been verified that electrical stimulation of the dorsal column, peripheral afferents, and descending pain inhibitory circuit can "reduce pain in patients. "In the 1970s, the first portable TENS machine was created and used intravenously to treat chronic pain. It was eventually discovered that the pain alleviation obtained from the antenna itself was adequate. The procedure was initially used on the spinal cord.

Accordingly, the researchers never kept the intrusive, unpleasant implant. Since that time, Medtronic has been the only company to produce a TENS device. In treatment, Medtronic was utilised of Parkinson's disease [5] and epilepsy. TENS, sometimes known as electronic dental anaesthesia, was recognised by researchers as one of the anaesthetic agents [2].

DEFINITION OF TENS :

TENS is defined as the Electrical stimulation transcutaneous applied by a battery powered TENS Unit for Relieving pain by interfering the neural transmission of nociceptive signals from pain Origin . Every therapeutic device that applies electrical stimulation to the intact skin surface is referred to be a TENS unit. A range of TENS tile devices have been launched to the medical device market. Manufacturers emphasise the differences between the various brand names and how they differ from TENS devices [7]

PARTS OF TENS:

- TENS Unit
- Lead wires
- Electrodes

Fig:1 Parts of TENS

TENS Unit:

It is a powered battery device which produces electrical impulse via electrodes. It has 2 variations.

1. "Clinical" Models: These are used by dentists in their offices and are powered by an electrical outlet in the building. It signals the success of the AC 60 cycle current.

2. "Patient" Models: These are small, comfortable, and affordable for the patient. Its energy source is alkaline-pricked cadmium. Depending on pain relief, energy sources can stimulate using a single-channel or dual-channel system. If there is sufficient pain alleviation between two electrodes (single channel). The dual channel is preferable if pain is present in multiple places.

Lead wires:

These allow an electrical connection between the electrodes and the TENS unit [3]

Electrodes:

By using electrodes, the "TENS unit's electric flow is transformed to an ionic aucent flow in live tissue. Implantation of electrodes within & outside the mouth is both conceivable. Extra-Oral Electrodes come into 2 Varieties, With the aid of an electrically conductive gel, flexible electrodes composed of silver rubber that has been impregnated with carbon are connected to the Skin Surface to Keep them in place, surgical tape is applied. Using Cotton pads or sponges soaked in tap water, or aluminum electrodes that do not Conform to the body are connected to the Skin's surface. The Intra-Oral electrodes are Cotton roll electrode clamp electrodes & sticky electrodes. The most popular electrode type today is sticky electrode [3] Fig :1 Parts of TENS mentioned above

TYPES OF TENS:

There are three forms of TENS therapy

1. Conventional TENS
2. Acupuncture - Like TENS
3. Intense TENS

1. Conventional TENS:

The most widely used technique for sharing current information in clinical practice.
Conventional TENS is described as "high frequency (50-100 Hz), low-intensity (paraesthesia, not painful), small pulse width (50-200 μs)" by the International Association for the Study of Pain (IASP) [2]. The selective stimulation of A-beta fibres is the justification for the use of conventional TENS. These are non-noxious, large-diameter afferent neurones that have a low threshold for pain [8]. Conventional TENS blocks nociceptive transmission to the central nervous system by treating non-pain paraesthesia [4]. In order to create a powerful, comfortable, and painless paraesthesia beneath the electrodes, the amplitude of the TENS pulse is increased. It can be worn all day long, however in order to avoid skin imitation, it's crucial to take breaks sometimes [2]. Used to treat acute, chronic, and simplified pain [2]

2. Acupuncture - like TENS (AL-TENS):

In the 1970s, Sjolund and associates described AL-TENS, a type of hyperstimulation. If patients don't react to conventional TENS, it can be utilised [6]. "Low frequency (2-4 Hz), higher intensity (to tolerate threshold), longer pulse width (100-400 μs)" is how IASP defines ALTENS.In clinical practice, high-threshold peripheral afferent neurones are stimulated by low frequency trains or bursts (2-4 Hz) of high frequency pulses (€100-200 pps). The descending pain inhibitor pathway is activated as a result. Muscle twitching is observed during treatment because it activates different muscle afferent nerve fibres. Placement of electrodes for pain treatment on trigger points, myotomes, or acupuncture sites [8]. Three times a day, for approximately twenty minutes, AL-TENS is utilised; otherwise, it may cause weariness from continuous muscle contraction. It helps individuals who are resistant to traditional methods and who have radiating neurogenic pain, deep suture discomfort, or pain related to changed skin sensitivity [2] For acute and chronic pain Deep sutures can cause radiating neurogenic pain.

3. Intense TENS

Intense TENS is intended to activate an extra segmental analgesic mechanism by stimulating small diameter, high threshold cutaneous afferents (A-delta) to block nociceptive information transmission in peripheral nerves. High frequencies (up to 200 pps) and high intensities (that are just tolerable to patients) are used, but only for brief periods of time. As a Gunter irritant, intense TENS is helpful for minor procedures such dressing wounds and removing sutures [6] in cases of acute or persistent pain [2]

MECHANISM OF ACTION-TENS:

Currently, TENS is a tool used for electrical simulation and pain control. TENS primarily works by modifying the neurological system to change how pain is perceived. It does this by applying low-voltage electrical currents to the skin through electrodes that are positioned on or close to the area of pain [4] Analgesic Effect of TENT IS Bounded on two main theories -

1.Gate Control theory of pain.

2. The Endogenous Opioid theory

Gate Control theory of pain:

Gate Management. The most widely accepted theory to describe how TENS works was the theory of pain put forth by Melzack and Wall in 1965. In short, it implied that a "gate" existed through which a nerve sent a pain signal to the brain. They proposed as well. That the nerve detects fibres, including big fibres (A-beta) and small fibres (A-delta & C fibres). Project to the first Central Transmission (T) cells in the dorsal horn of the spinal cord and the Substantia Gelatinosa (SG) of the dorsal horn . By identifying the kind of nerve that would convey the specific signal, SG Convicts of inhibitory interneurons act as a gate. Pain is transmitted by tiny unmyelinated C fibres to T-cells, and their activity maintains the Gede in a comparatively open posture. Large myelinated activity A fibres are in charge of closing the gate and acting as a presynaptic inhibitor on input from C fibres, which stops impulses from reaching + cells. It is possible to control pain. By growing. Dosing the gate involves increasing the large fibre input and decreasing the small fibre input [1] (figure : 2 Gate control theory mentioned below)

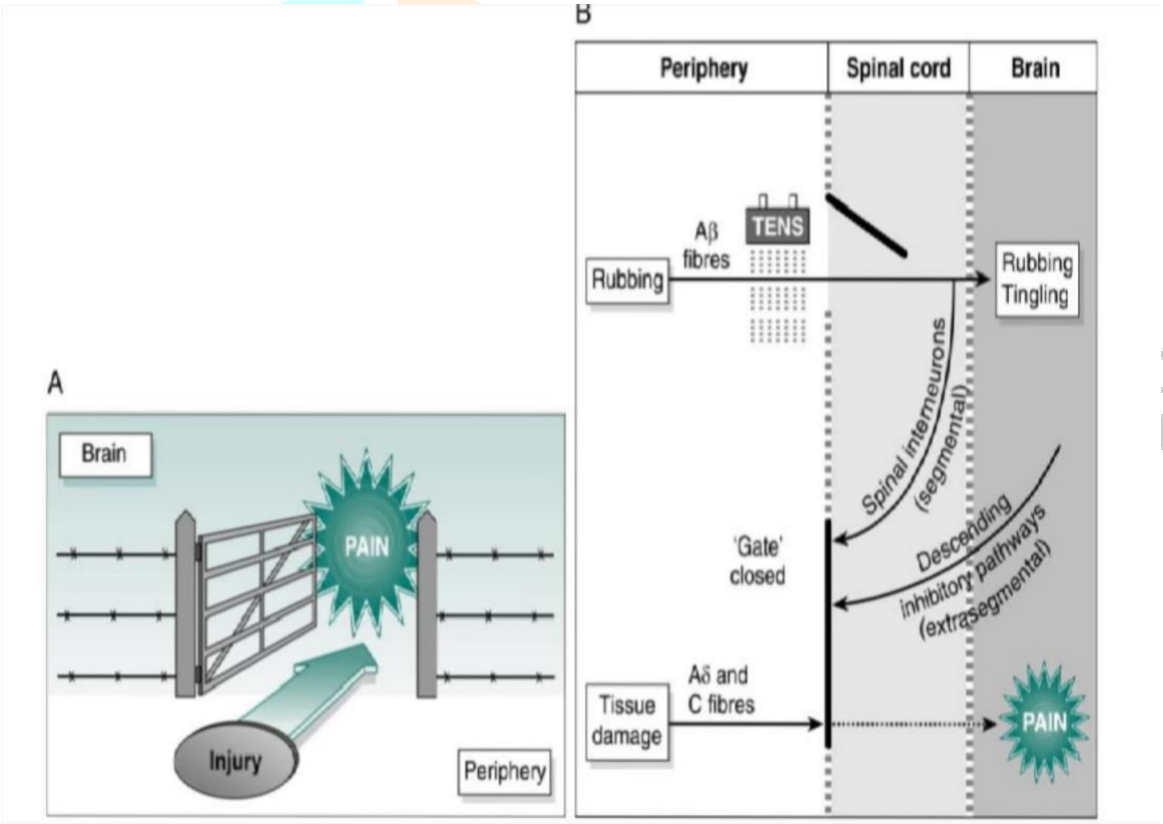

Fig. 2 The Gate Control Pain Theory. Under typical physiological conditions, the brain may produce pain in response to unpleasant information that enters through inputs like tissue injury. This metaphorical 'gate', which is situated in lower levels of the central nervous system, is necessary for harmful information to enter the brain. In terms of physiology, the gate is made up of excitatory and inhibitory synapses that control how information moves through the central nervous system. This 'gate' tends to be opened by adverse events in the periphery and closed by TENS activating large-diameter Aß peripheral afferents or by activating mechanoreceptors by 'rubbing the skin'. This closing of the 'gate' reduces noxious information reaching the brain. The neuronal circuitry involved is segmental in its organization. The aim of conventional TENS is to activate Aß fibres using electrical currents. The 'gate' is closed, allowing less harmful information to enter the brain. The associated neural circuitry is segmentally organised. Conventional TENS uses electrical currents to stimulate Aß fibres. Additionally, the 'gate' can be closed

by activating inhibitory pathways, which start in the brain and travel down the brain stem (extrasegmental circuitry) to the spinal cord. These pathways become active when smalldiameter peripheral fibres are physically aroused and during psychological processes like motivation. AL-TENS aims to activate the descending inhibitory pathways by stimulating smalldiameter peripheral fibres.

Endogenous Opioid theory: Reynolds demonstrated in 1989 that electrical stimulation of the midbrain's persevere ductal grey region results in analgesia comparable to that produced by morphine. Following this discovery, a number of morphine-like compounds, such as betaendorphins, were shown to exist at different levels of the central nervous system [7]

ELECTRICAL PARAMETERS OF TENS:

The Adjustable electrical parameters in TENS includes,

- Pulse Intensity
- Pulse Frequency
- Pulse Duration • Wave form (pattern)

PULSE INTENSITY:

Depending on the patient's reaction, pulse intensity is often divided into three levels: sensory, motor, and microcurrent. Without any motor contraction, the patient experiences a pleasant paraesthesia, such as a tingling or tapping sensation, due to the defined amplitude of sensory level intensity. Low intensity, which is typically moderate for conventional TENS, was also denoted by this amplitude. The amplitude causing a motor level contraction with paraesthesia is known as motor level intensity. Similar to TENS, it is also referred to as high intensity and is utilised in acupuncture. Usually used in strong TENS, the intensity can occasionally be raised to the maximum level just before being toxic.

PULSE FREQUENCY:

Electrical current pulse frequency is often categorised as either low frequency or high frequency (>50 Hz). (less than 10 Hz) and burst, which is the application of high frequency current at a considerably lower frequency. It was discovered in the past ten years that high frequency PENS may also provide analgesia by causing the central nervous system to generate endogenous opioids. Several target receptors "through" High frequency TENS reduced the increased release of glutamate and aspartate in the spinal cord receptors by activating delta opioid receptors, but low frequency TENS worked through mu opioid receptors.in contrast to the strength of the pulse. It is reasonable to assume that TENS pulse frequency has less of an impact on hypoalgesia than intensity.

PULSE DURATION:

Pulse duration is categorised as either larger or shorter (less than 200 μs). According to the statement, a greater pulse duration produced a deeper effect and more intense experience.An investigation revealed that the degree of antihyperalgesia induced by high frequency TENS was unaffected by the duration of the pulse.

WAVE FORM:

The switch in electrode polarity, which involves changing the cathode and anode between two electrodes, determines whether a pulse waveform is monophasic or biphasic. Symmetric and asymmetrical waveforms are two subclasses of biphasic waveform. The term "symmetrical biphasic waveform" refers to a symmetrical waveform in which the first phase is mirrored and has opposite polarity to the second phase, which is then equivalent in terms of electrical quantities. Electric flows beneath the cathode and anode. Theoretically, there will be no net current flow beneath the two electrodes of a TENS unit with a symmetrical biphasic waveform, but there will be an accumulation of ion concentrations with a specific change beneath the electrodes of a monophasic waveform. Most modern TENS units use a biphasic waveform for safety since excessive ion concentration buildup is more likely to result in negative skin reactions. For moderate ion accumulation, an asymmetrical biphasic wave shape was occasionally used, which produced a minor concentration preference polarity beneath the electrodes [7]

TENS PROCEDURE:

Accurate electrode placement is a crucial and time-consuming process in TENS. Always insert electrodes on healthy, intact skin that has changed in sensation. There are two types of electrodes used in TENS, and units with four electrodes may occasionally be required for extensive pain. Relevant dermatomes should be chosen. Both intra- and extra-oral. The extra-oral electrodes are impregnated with Caution. Aluminium electrodes, tin plates, or silicone rubber electrodes. Sublingual Electrodes consists of sticky electrodes, a clamp, and cotton rolls [8]. Pulse education stimulation is utilised in tens therapy at various frequencies and intensities. A frequency of 2012 and a time deviation of 30 minutes are two commonly used treatment parameters. The number of treatment sessions varies greatly depending on the therapeutic requirements [7]

GENERAL APPLICATION OF TENS:

The subjects were instructed to assume an upright posture. To finish the circuit, surface electrodes were positioned in the sigmoid notch region of the back of the neck, and TENS treatment was administered for "duration completed, including follow-up, in three to four sittings. Sections were completed twice a day to twice a week for fifteen minutes each.Low frequency TENS, or 25 to 150 Hz for high frequency TENS, with sufficient intensity—that is, a robust, subnoxious, maximally bearable stimulus—or >15 mA was linked to postoperative pain. 30% reduction in pain [8] Figure :3 General application of TENS mentioned below)

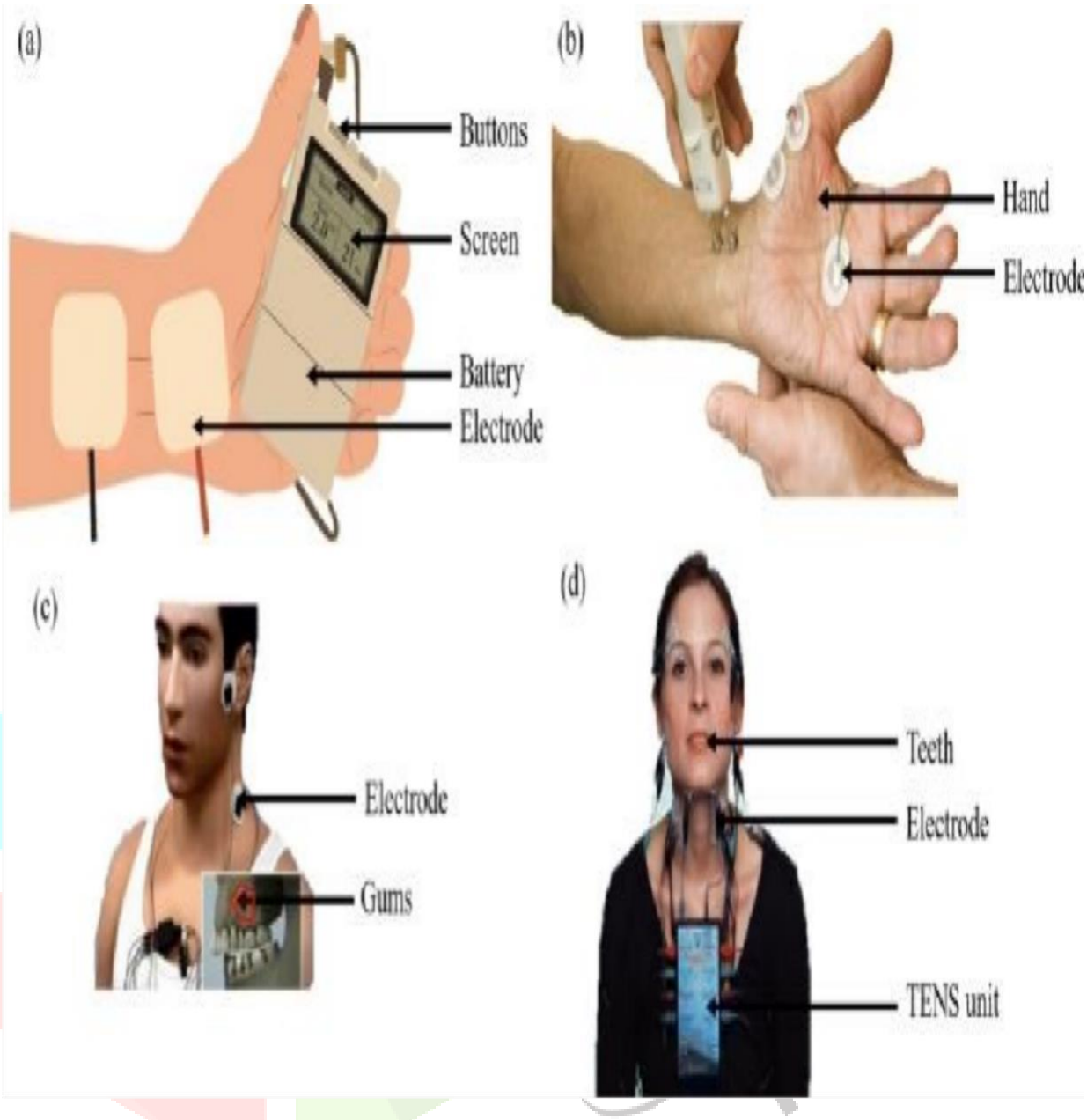

Fig:3 General application of TENS

DENTAL APPLICATION :

Following the manufacturer's instructions, TENS electrodes (diameter 35–52 mm) were applied bilaterally to the mandibular elevator muscles, the superficial masseter, which is the muscle above the anterior temporal gonial angle, and both muscles. All patients in both groups had the same application of the device, which was left in place for the same amount of time (30 minutes); however, the control group received stimulation and the device was turned on. Throughout the 30-minute sessions, the experimental group's stimulation frequency and intensity were maintained at the highest level possible without causing discomfort or areas of contraction. Over the course of four weeks, each person had a weekly TENS or sham-TENS session on the same day of the week. Appointments were planned to minimise potential interaction between research participants .(Figure :4 Dental application of TENS mentioned below)

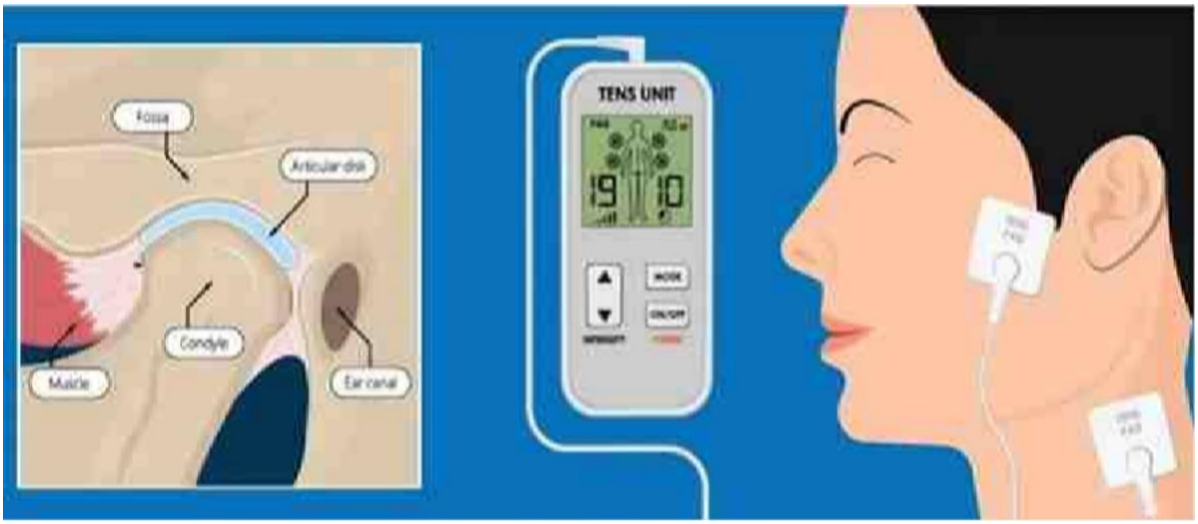

Fig:4 Dental application of TENS

ADVANTAGES OF TENS:

1. Easy to handle, safe, and non-invasive [2]
2. It can be utilised with a portable machine at home [2]
3. It can be used to put patients who are afraid of needles to sleep [1]
4. TENS is superior for reducing pain and sensitivity [2]
5. Patients can learn how to titrate dosages based on their uncomfortable condition and self administer TENS treatment. The patients' positive acceptance of this outcome [1]
6. After the TENS unit is switched off, there is postoperative anaesthesia as opposed to local anaesthesia [1]
7. It helps with musculoskeletal pain and four types of neurogenic pain [2]

DISADVANTAGES OF TENS:

For some people, the electrodes in particular might result in skin irritation, including redness, itching, and adhesive pad breakouts.

1. Unpleasant stimulation :

   Some people find the electrical stimulation uncomfortable or unpleasant; it may feel like a tingling, buzzing, or prickling sensation.

2. Allergic Reactions:

   Skin rashes, redness, or swelling could result from allergic reactions to the adhesive pads.

3. Limited Effectiveness:

   TENS may not work for everyone, and using it may not significantly reduce pain for some people.

4. Misuse potential:

   TENS may not offer the best pain relief and may even be harmful if not used appropriately or under a doctor's supervision.

5. Not a Substitute for Medical Care:

TENS should be viewed as a management tool rather than an additional pain reliever in place of getting the right medical guidance and treating underlying conditions.

INDICATION OF TENS:

The fundamental. Indication for TENS is seeking to manage pain, both acute a chronic [9] TENS is effective for neuropathic, nociceptive & musculoskeletal pain [9]

Specific Indications:

- CHRONIC PAIN:

Used for various types of Chronic pain both Nociceptive (tissue damage) & neuropathic (nerve damage)

- MUSCULOSKELETAL PAIN:

1. Low Back Pain (LBP)
2. Osteoarthritis (OA) of keenly other joints

3.Localized muscle pain Tendinitis & bursitis.

- NEUROPATHIC PAIN:

1. Post herpetic Neuralgia
2. Trigeminal Neuralgia
3. Entrapment Neuralgia
4. Phantom limb
5. Painful diabetic Neuropathy
6. Complex Regional pain syndrome (ERPS)

Other pain Conditions:

1. Fibromyalgia
2. Chronic pelvic pain
3. Post surgical pain
4. Post traumatic pain
5. Cancer & cancer-related pain
6. Spinal cord injury with Neuro pain

The These types of TENS are outlined with their Conceptual indications [9]

INTENSE TENS:

Mostly used as a “counter irritant,” this kind of TENS aims to prevent the transmission of nociceptive information in nerves by targeting the small diameter, high threshold cutaneous afferent (A-delta). While promoting other analgesic processes. For brief periods of time, both high frequencies and intensities are employed [9].

ACUPUNCTURE-LIKE "TENS (AL-TENS):

An alternative to conventional TENS for hyperstimulation is AL-TENS. The goal of low frequency titration is to activate peripheral afferents with a small diameter and a high threshold (Adelta)[7]

CONVENTIONAL TENS:

uses a tiny pulse width, low intensity, and high frequency. Selectively stimulating large diameter, low threshold, non-noxious afferents (A-beta) is the aim. This method is popular for treating dermatomal pain distributions [9]

CONTRAINDICATIONS OF TENS:

1. Rarely do severe adverse effects occur [16]

2. Patients with bleeding disorders, epilepsy, cardiac pacemakers, and pregnancy should not get TENS (19–24) [2] Parents with pacemakers in their hearts – (6,13)

3. Since most patients are not aware of the type of pacemaker they use, it is recommended that TENS not be used on them. TENS currents can interfere with the function of a pacemaker if the electrode is placed in the thoracic area, with the exception of fixed rate pacemakers [1]

4. Pregnancy: The FDA has not approved it despite certain negative effects [10, 11 ,2]

5.Epileptic patients: "TENS" pulses may intensify a seizure [12,1]

6. Cerebrovascular issues: they can cause peripheral blood flow to be stimulated, which can sometimes result in death (shake, aneurysm, transcent, ischaemia) [13,2]

7. Patients who are anxious: TENS requires patient cooperation, which is why the technique Should he try with individuals who have a mental illness or a communication impairment? The condition may be misdiagnosed due to the suppression of warning indicators caused by pain of unknown aetiology [13,2].

8. The placement of electrodes should be avoided. For a patient with a treatable tumour, over an aggressive tumour [6]

9. Transdermal dung delivery systems should not be near TENS [6]

10. The only common issue is related allergic dermatitis, which the patient experiences because of the adhesive tape holding the electrodes in place.

11. Electrodes are not placed over the eye, open wounds, recent haemorrhage, thrombosis, ischaemic tissues, and malignancy (except in palliative causes [4,9,14,2,15]

12. At the simulation site, there is mild erythema due to inadequate electrolyte; gel is used when a burning, prickling feeling occurs.

13. Race is one of the major adverse outcomes from TENS. Contact dermatitis and Stein invitation below The electrodes could appear, thus skin care is crucial.

14. Some patients may experience faintness and nausea [6]

CLINICAL APPLICATION:
IN GENERAL PRACTICE

➢ *Applications of TENS in Acute Pain :*

With its instantaneous, non-analgesic, and anxiolytic effects, TENS has demonstrated promise in the pharmacological treatment of acute pain. Despite this, methodological issues and small sample sizes limit the clinical dater. Such being insufficient blinding, preliminary research indicates.In acute situations, that TENS score. For example, pain from Sigmoidoscope procedures, colonoscopy, hyperoscopy, post-cardiothoracic surgery, pain from haemophilia, and acute back pain that has been demonstrated to benefit from TENS. TENS has shown promise as a safe and effective solution in acute settings by effectively lowering pain, anxiety, and anxiety in prehospital care without causing major negative side effects [4]

➢ Application of TENS in chronic pain:

TENS is used to treat chronic pain by stimulating nerve cells and changing how pain is perceived by applying a low voltage electric current to the skin through electrodes. This. Numerous conditions, such as fibromyalgia, neuropathic pain, osteoarthritis, and back pain, can benefit from non-invasive treatments. TENS is thought to function by boosting the body's natural endorphin release and blocking pain signals in the back. Noteworthy is the decision between high and low frequency. Because low frequency TENS has a longer opioid release, it might be more beneficial for chronic pain.

PAIN MANAGEMENT:

TENS is Commonly used in pain management for Conditions such as

➢ **OSTEOARTHRITIS**:

degenerative joint condition that results in stiffness, discomfort, and reduced mobility when moving or bearing weight.It can hurt their legs, around specific duties, and make it difficult for them to perform certain tasks.The decline in predicted pain management was negligible and not statistically significant [16]. The evidence for TENS's short-term effectiveness in reducing knee osteoarthritis (OA) pain is moderately strong, according to multiple systematic reviews. (90–93, 104) According to a RET, TENS should not be investigated further for the treatment of pain in individuals with osteoarthritis in the knee [10.] Even though this research had an analysis and enough participants per arm, it's possible that the TENS intervention used a dose that was sufficient to provide a noticeable decrease in pain. TENS can continue to be helpful for a year, according to at least one RCT in this newly developing field of study [16]

➢ **NEUROPATHIC PAIN:**

Damage to the nerve system is usually the source of neuropathic pain. This may be the consequence of nerve pressure or injury. The patient is experiencing typical symptoms, such as shooting pain, numbness, and tingling. Neuropathic discomfort. For patients with neuropathic pain, the capacity to control inflammation is essential to minimising suffering. TENS may help with neuropathic pain because it has been shown to lower pro-inflammatory cytokines.

➢ **CANCER PAIN:**

In the context of palliative care, both adults and children have experienced success with TENS. Metastatic bone disease, secondary deposit pain, and pain from neoplasm-induced nerve compression can all be treated with TENS. (See Johnson et al. 2012 for a review.) TENS has been used to treat neuralgias, including post-mastectomy pain, and neuropathic cancer pain brought on by tumour infiltration or nerve compression by a neoplasm. Numerous clinical trials have been conducted to examine the analgesic effects of TENS on neuropathic pain associated with cancer. According to a case report, a 63-year-old woman with cancer bone pain was satisfactorily relieved by TENS (80^{th}) . Furthermore, in a research conducted at

a major cancer clinic, 69.7% of patients claimed that TENS helped them. Furthermore, after two months of follow-up, researchers at a large cancer center discovered that TENS significantly reduced the intensity of pain in 69.7% of patients .In conclusion, results regarding TENS's analgesic effects on neuropathic pain associated with cancer are inconclusive and should be investigated further in a large multicenter KCT.

➢ **POST HERPETIC NEURALGIA (PHN):**

A type of neuropathic pain known as PHN is brought on by Herpes Zoster (HZ) reactivation, which damages peripheral nerves [17]. The myelinated fibres in vast areas are damaged. As a result, the typical pain stimulus is gone. This results in hyperalgesia and pain. Traits associated with post-herpetic neuralgia [8] Clinically defined by a variety of aberrant sensory symptoms (e.g., hyperalgesia, allodynia) and spontaneous or induced pain syndromes (e.g., sheep, stabbing, scorching). & Sensory low) , which significantly impact patients' quality of life [17] Kolsek suggested that TENS could treat herpes zosker either in addition to or without of antivirals. They also noted that TENS seems to be useful in preventing post-herpetic neuralgia [8].

➢ **PERIPHERAL ARTERIES :**

Peripheral artery occlusion and gradual narrowing are hallmarks of PAD. Mostly as a result of atherosclerosis .Atherosclerotic plaques that form within the arterial walls of the arteries start the degenerative process by reducing blood flow, which in turn reduces the amount of oxygen and nutrients that are delivered to the affected times. The possibility of TENS as an additional therapy for the management of PAD, especially in patients with intermittent claudication, has been investigated in recent studies. TENS may help this patient population's walking distance and exercise tolerance, according to new research.

➢ **TEMPOROMANDIBULAR DISORDERS:**

When compared to normal, subjects with TMD have been found to have increased myoelectric activity in their mandibular elevator muscles. TENS treatment causes the muscles' myoelectric activity to diminish as well. Shanavas et al. Conducted a study to determine the efficacy of TENS as an adjuvant therapy for temporomandibular disorders (TMD). One group received adjuvant TENS treatment, while the other group was treated with medicine alone. The intensity of pain was assessed using the VAS. Both the TENS group and the controls experienced significant pain alleviation; however, when compared to the use of medication alone, adjunct TENS was linked to greater pain relief. TENS dramatically reduced the severity of pain in individuals with TMJ and muscle discomfort, according to "Rela & Nayyar." TENS, however, has no effect on the position or shape of the jaw or teeth [8] .

IN DENTAL PRACTICE:

➢ *Xerostomia*

Both healthy people and xerostomia patients experience an increase in salivary flow rate when TENS is applied. After applying TENS to the skin overlying the parotid glands, two-thirds of healthy adult individuals had enhanced salivary flow, according to Hargitai et al. in 2003 [1.] To find out how well TENS increased saliva production, Talal et al. Conducted a multi-center, double-blind trial for Sjogren's syndrome patients in 19.92 [2] In order to ascertain the viability of AL-TENS in a multi-center setup and its effectiveness in reducing radiation-induced xerostomia in 48 cases, Wong et al. Carried out a study in 2012.For 12 weeks, 20 minutes of ALTENS were administered every week. A systematic evaluation by Sivaramakrishnan and Sridharan [2] reported no significant increase in salivary flow following TENS therapy in 58 individuals. They did note, though, that it might be used as a salivary aid to get rid of symptoms [8] .

➢ *Trigeminal Neuralgia:*

According to a case study by Thorsen & Lumsden, an 86-year-old man's trigeminal neuralgia symptoms instantly and permanently vanished when a strong TENS discharge was administered by mistake. Trigeminal neuralgia, a severe paroxysmal pain, can be treated by heating the afferent bigeminal fibres in the mandibular region to make them refractory [2]. As a result, they thought that high-intensity TENS might have enduring effects [2].

➢ *Orthodontic pain:*

A New Research assessed how well the new portable TENS worked to monitor orthodontic pain and how long it lasted after being applied [2] .Patients who had pain right after following orthodontic correction or wire activation were included in this study, and it was discovered that applying a little electric current significantly lessened pain. The effects of "TENS therapy" on the periodontal copies of orthodontic separators put on the mesial and distal aspects of upper first molars in 45 individuals were noted by Roth and Thrash in 1986. Parents who used TENS reported significant discomfort over the 24, 36, and 48 hour assessment periods, but no pain was felt right away or within the first 12 hours.

➢ *Temporomandibular disorders:*

When compared to normal, it has been noted that those with TMD exhibit higher myoelectric activity of the mandibular elevator muscles. Pain is reduced with TENS therapy. Additionally, my myoelectric strength has diminished. Muscle activity.Shavana et al. Conducted a study to determine the efficacy of TENS as an adjuvant therapy for TMD. Medication alone was used to manage one group. Adjuvant TENS was used to treat them. The intensity of pain was assessed using the VAS. Both the controls and the TENS group experienced notable pain relief. However, after doing a comparative investigation, the treatment Did the use of adjunct TENS result in greater pain relief When contrasted with drug use alone.TENS significantly reduced TMJ and muscular discomfort, according to Rela and Nayyar's findings. TENS does not, however, intensify patients' changes in jaw and tooth position or structure [8] To ascertain and compare the efficacy of active TENS, a cross-sectional study was conducted. Additionally, PT helps patients with TMD control their pain. "122 patients are included in this study." 61 patients received PT and active TENS. Both active and TENS treatment as well as routine physiotherapy showed a notable decrease in pain. According to a comparative analysis, TENS treatment helped individuals with TMD control their pain [2] .

APPLICATION IN PEDIATRIC PATIENTS:

Fear toward syringes is a frequently noted unfavourable behaviour in paediatric patients. The use of TENS improves paediatric patients' behaviours and lowers their anxiety levels. Since it eliminates the "fear of needles."53–78% of children (ages 14–16) choose TENS to local anaesthesia, according to studies. TENS has been successfully used to manage pain in paediatric patients throughout a variety of operations, including the installation of pit and fishers sealants, cavity preparation, small extractions, and endodontic procedures [1] TENS therapy alters the individuals' behaviour, which reduces their anxiety. Lessens children's "trypanophobia."[8] .

APPLICATION IN ADULT PATIENT:

Adults have utilised TENs as a great analytical tool for a variety of procedures, such as the installation of rubber dams. Cavity preparation, extractions, prosthetic tooth predictions, pulp capping and other endodontic insertion procedures, and oral prophylaxis. Additionally, it is utilised to lessen periodontal pain related to orthodontic separation and the discomfort caused by local anaesthetic injections.HECHMAN [14] asserts that TENS is less effective in "sceptical" and "highly painsensitive" patients. He stated that 83% of

TENS operations (such as prophylactics) were successful, 76% of restorative procedures, and 55% of crown and bridge work were successful [1] .

SAFETY OF TENS:

A lot of people have TENS. It's a safe gadget. TENS uses a low voltage output that is safe for humans since it stays below the threshold that could harm skin or tissue. Furthermore, the capability to modify the parameter The frequency and intensity of electrical stimulation enables medical professionals to modify TENS therapy in a precise and customised manner. This enables each patient to receive the best care possible. Particularly tailored comfort Mild side effects should be mentioned, nevertheless. These adverse consequences Incorporate muscular spasms and skin stimulation Discomfort [12].

CONCLUSION OF TENS:

An efficient, non-invasive, and drug-free method of managing pain is TENS. TENS helps people with acute pain disorders by modulating pain signals, stimulating endorphin release, and improving their quality of life through the delivery of controlled electrical impulses. Even yet, patient outcomes may differ, and further research is required to provide standardised therapy methods. TENS Continue to be a useful and approachable supplement to traditional pain management techniques.

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